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HANDBOOK OF INSTRUCTIONS
OPERATION AND MAINTENANCE

RADIO RECEIVERS
BC-341-F and BC-357-H

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4. TYPE OF AIRPLANE IN WHICH INSTALLED
5. RECOMMENDATIONS

NOTICE

This Instruction Book has been divided into two parts. PART A to cover RADIO RECEIVER BC-341-F (12 volt) and PART B to cover RADIO RECEIVER BC-357-H (24 volt.)

Except for the difference in filament voltage required and a by-pass condenser in Radio Receiver BC-341-F, these two models are identical.

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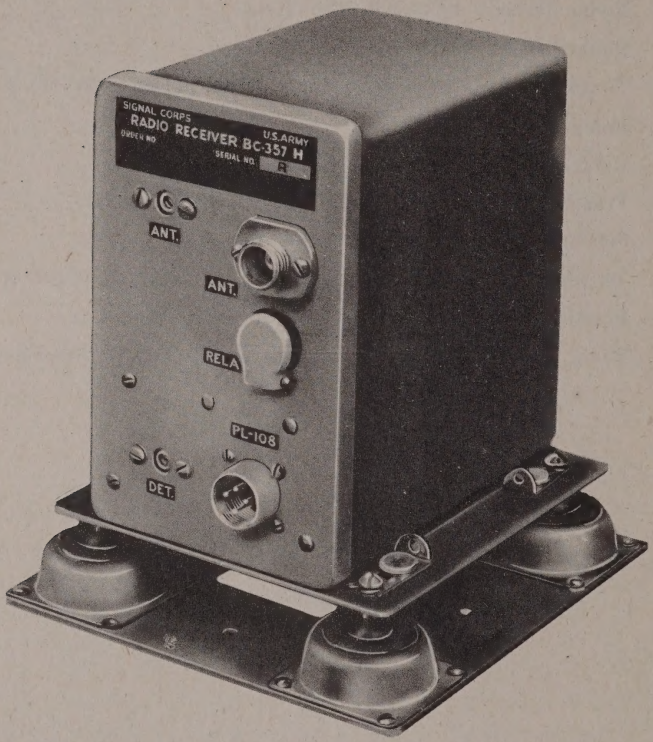


Figure 1 — RADIO RECEIVER BC-357-H IN CASE ON MOUNTING FT-161, DIAGONAL FRONT VIEW

PART A

RADIO RECEIVER BC-341-F
(12 VOLT)

SECTION I. GENERAL CHARACTERISTICS

1. Description of Receiver

a. Radio Receiver BC-341-F is an ultra high frequency receiver for aircraft use. The frequency range is from approximately 62 megacycles to 80 megacycles. The purpose of the instrument is to receive 75 megacycle marker beacon signals of the Army instrument landing system, the Civil Aeronautics Administration cone of silence, fan marker beacon and other facilities employing modulated 75 megacycle horizontally polarized transmissions.

b. The receiver uses the following tube complement: duplex diode pentode Tube VT-153 and duplex diode triode Tube VT-104. The complete receiver is shown in figures 1, 5 and 6. Tube VT-153 functions as a radio frequency amplifier, detector and audio frequency amplifier. Tube VT-104 functions as an audio frequency amplifier and rectifier which supplies the relay current.

c. The sequence of operation upon the received modulated signal is as follows:

(1) Pick-up by the half wave antenna.

(2) Amplification at 75 megacycles, diode detection, and a-f amplification by the first tube.

(3) Additional amplification and rectification of the audio signal by the second tube to produce the direct current for operation of the relay which controls the lamp circuit.

2. Power Requirements

Radio Receiver BC-341-F receives its high and low voltage power from the radio compass power supply. This power is controlled by the "ON-OFF" switch on the radio compass. Power required by Radio Receiver BC-341-F is 0.3 amperes at 12 volts for the filament supply, and 7 milliamperes at 220 volts for the plate supply. There is also a small amount of power used intermittently by the indicator lamp on the instrument panel.

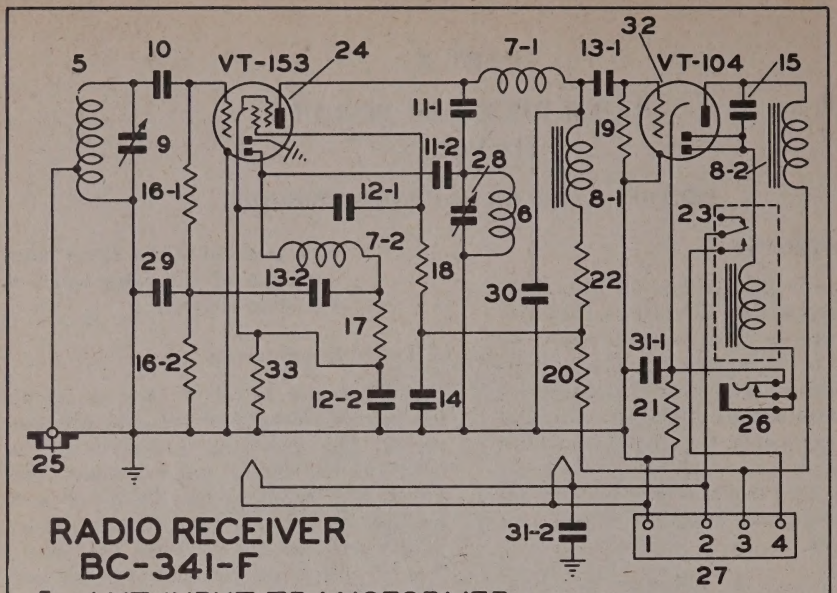
3. Component Parts

Radio Receiver BC-341-F consists of the component parts listed in alphabetical order below:

Quantity	Description	Dimensions	Unit Weight (lbs.)
1	Mounting FT-161	5½" x 5⅞" x 1½"	0.5
1	Radio Receiver BC-34-F less mounting	5⅜" x 5⅜" x 3 7/16"	2.65
1	Tube VT-104	2⅝" x 1⅜"	0.071
1	Tube VT-153	3¼" x 1⅜"	0.065

4. Weight

The weight of Radio Receiver BC-341-F, including mounting bracket and tubes, is 3.25 lbs.



RADIO RECEIVER BC-341-F

5	ANT. INPUT TRANSFORMER	
6	DETECTOR TUNING COIL	
7	R.F. CHOKE (2 REQ'D.)	
8	AUDIO CHOKE (2 REQ'D.)	
9	TUNING CAPACITOR, 17 MMF.	
10	CAPACITOR, CERAMIC 15 MMF.	
11	CAPACITOR, CERAMIC 50 MMF. (2 REQ'D.)	
12	CAPACITOR, MICA .004 MFD. 500 V. (2 REQ'D.)	
13	CAPACITOR, MICA 1500 MMF. 500 V. (2 REQ'D.)	
14	CAPACITOR, PAPER 0.5 MFD. 400 V.	
15	CAPACITOR, PAPER .034 MFD. 600 V.	
16	RESISTOR, 1 MEGOHM	1/4 W. (2 REQ'D.)
17	RESISTOR, 560,000 OHM	1/4 W.
18	RESISTOR, 270,000 OHM	1/4 W.
19	RESISTOR, 2.2 MEGOHM	1/4 W.
20	RESISTOR, 22,000 OHM	1/2 W.
21	RESISTOR, 1000 OHM	1/4 W.
22	RESISTOR, 6800 OHM	1/4 W.
23	RELAY	
24	TUBE SOCKET	
25	ANTENNA JACK	
26	RELAY JACK	
27	SOCKET SO-88	
28	DETECTOR TUNING CAPACITOR, 17 MMF.	
29	CAPACITOR, MICA 150 MMF. 500 V.	
30	CAPACITOR, MICA 75 MMF. 500 V.	
31	CAPACITOR, MICA 500 MMF. 500 V. (2 REQ'D.)	
32	TUBE SOCKET	
33	RESISTOR, 560 OHM	1/4 W.

Figure 2 — SCHEMATIC CIRCUIT DIAGRAM, RADIO RECEIVER BC-341-F

SECTION II. EMPLOYMENT

5. Initial Procedure

a. Check to determine that all component parts as listed in Paragraph 3, Section I, are available.

b. Insert the tubes in the proper sockets and check to make sure that socket contacts and tube prongs are in full engagement. Insure a firm contact for the grid lead to the cap of Tube VT-153.

c. Examine the receiver for mechanical defects and make sure that the chassis cover is secured to the chassis.

6. Installation

a. Choose the location of Radio Receiver BC-341-F in the aircraft by consideration of the following factors:

(1) Accessibility for tube replacement, tuning, and relay adjustment. This is an important consideration, because the receiver is subject to frequent test and inspection.

(2) Accessibility to power supply through the cable supplied with the aircraft by the manufacturer.

(3) Proximity to the antenna location. The length of the antenna transmission line is not critical, however.

b. Permanently fasten Mounting FT-161 in its chosen location in the aircraft. Fasten the receiver securely to the mounting, making sure that the snap slides are properly engaged and "safety-wired" to the posts of the mounting.

c. Connect the antenna plug to the socket marked "ANT." Connect the power plug to the socket marked Plug PL-108. Tighten both plugs securely, making sure they seat properly.

d. Radio Receiver BC-341-F may be used as a part of Marker Beacon Receiving Equipment RC-39-A or RC-39-B. Other important parts of this equipment are the antenna and transmission line. Consult the instruction book for Marker Beacon Receiving Equipment RC-39-A or RC-39-B in order to get a complete knowledge of all the components of the equipment concerned.

7. Preparation for Use

a. After the receiving equipment has been installed and all the connections made, proceed as follows:

(1) Turn on the radio compass. This supplies the power for Radio Receiver BC-341-F. Wait about one minute for the tubes to warm up.

(2) Apply a test signal to the receiver and check the tuning. This is done with Test Set I-76. (For a complete description of Test Set I-76 see the instruction book for that equipment.) Proceed as follows:

(a) Set test oscillator on the ground to the side of the aircraft about 10 to 20 feet from the radio receiver antenna. The test oscillator antenna should be extended to its full length and set parallel with the radio receiver antenna. The battery switch should be turned "ON" and the modulation set for 3,000 cycles.

(b) Connect Test Indicator BE-67 which is also part of Test Set I-76 to the output of the receiver by plugging one end of the cord, provided with Test Set I-76, into the jack, marked "RELAY" on the front of the radio receiver. The other end of the cord is plugged into the jack of the test indicator. Set the switch on the test indicator to the "TUNE RECEIVER" position, and the milliammeter will indicate the output current of the receiver when the latter is properly aligned and normal. If no indication is obtained, check the oscillator and refer to the instructions pertinent to the adjustment of that instrument.

(c) Use a screwdriver with a ⅛" blade for tuning the "ANT" and "DET" tuning capacitors. Tune for maximum response on the test indicator. If the "ANT" adjustment is

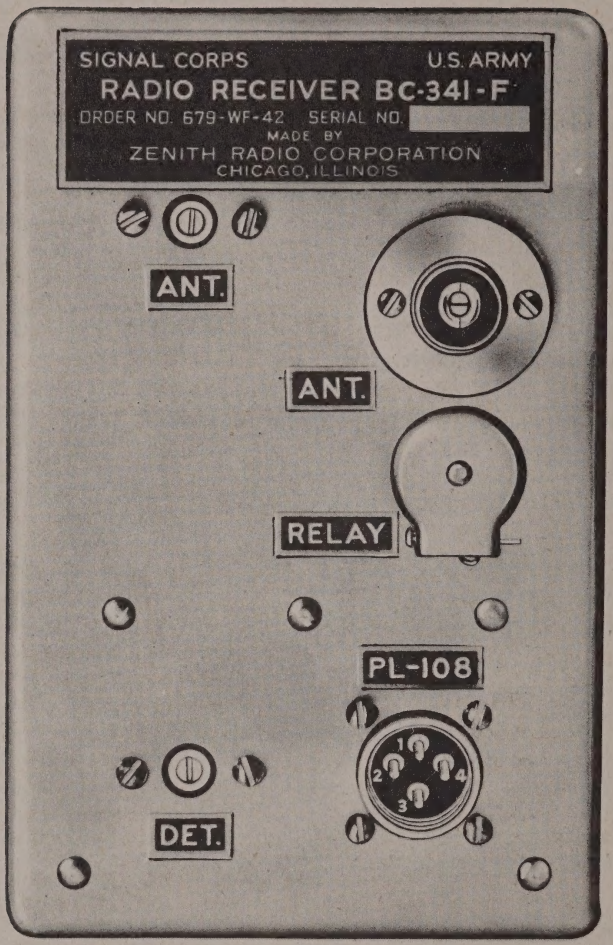


Figure 3 — RADIO RECEIVER BC-341-F, FRONT VIEW

very far off it is desirable to check from one to the other a couple of times and then tune "DET" last. If the output response exceeds 0.5 ma at the maximum response, decrease the length of the antenna on the test oscillator by collapsing the sections, or place the test oscillator at a more remote point. Rotation of the oscillator will also accomplish the same result. There should be no moving object in the vicinity of the test oscillator or the marker beacon antenna while the tuning adjustment is in progress. This tuning adjustment should always be made with the receiver chassis in its case.

(3) Remove test signal and check relay as follows:

(a) Hold the switch on Test Indicator BE-67 in the "ADJUST RELAY" position.

(b) Turn the control knob on the test indicator clockwise until the marker beacon indicator light goes on, and then turn the knob back until the light goes off. The relay should close at 0.4 milliampere (± 10%), as read on the meter in the test indicator, and open at 0.2 milliampere (± 10%). The procedure outlined in Paragraph 15 should be followed if the relay needs adjustment.

(c) After Test Indicator BE-67 has been disconnected, the receiver is ready for operation.

(d) Turn the test oscillator on, and observe that the indicator lamp on the instrument panel lights after the test indicator has been removed. This is a check that the jack circuit properly closes after the plug has been removed.

8. Operation

a. Radio Receiver BC-341-F is used by the pilot to determine when he is flying over a 75 megacycle marker beacon transmitter. Such a transmitter might be an Army instrument landing type such as Radio Transmitter BC-302 or Marker Beacon Projector A-1. When used with such transmitters for blind landing, the receiver gives the pilot distance indication from the end of a runway. For complete information as to how the receiver is used in such a situation, see instructions for the Army A-1 Landing System. Signals from fan type markers and cone of silence transmitters may also be received along commercial airways. The former type of marker gives the pilot an indication of his distance from an airport as he approaches along the radio range. Signals from the cone of silence transmitter tell the pilot when he has reached a point above the airport.

b. The receiver will respond to any audio-modulated 75 megacycle signal. The sensitivity of the receiver increases as the modulation frequency increases up to 3,000 cycles modulation to five normal output. This permits use of the receiver with the powerful 60 cycle modulated Army instrument landing system transmitters, without making it insensitive to the less powerful cone of silence transmitters.

c. The radio receiver indicator lamp will indicate during varying intervals, depending upon the type of marker, the altitude and speed of the airplane. Equal indications for any direction of flight are given over cone of silence markers. These last about one minute at 10,000 feet altitude, when the speed of the airplane is 150 miles per hour.

d. Radio Receiver BC-341-F is designed to minimize false or confusing signals caused by stray radiations, natural or man-made static, ignition interference or vibration.

e. Turning the radio compass switch "ON" is the only step required to bring Radio Receiver BC-341-F into operation. No other adjustments are required while the equipment is in use. Since the receiver has no power supply switch, other than the radio compass "ON-OFF" switch, the receiver and radio compass are always in operation together.

9. Precautions During Operation

a. To avoid faulty use of the equipment and misrepresentation of results, observe the following precautions:

(1) Receiver operates only with the radio compass switch in the "ON" position.

(2) When passing over a marker, the indication will be steady or intermittent depending upon whether or not the transmitter is keyed. Cone of silence markers and some Army instrument landing markers are not keyed. Keying is used to identify fan type and Civil Aeronautics Administration instrument landing markers. However, if the receiver does not follow the keying of a 100 watt fan marker transmitter when the airplane is passing through the strongest part of the beam at low altitudes, it does not indicate any fault in the receiver.

(3) Flickering of the indicator lamp which might be misinterpreted as a keyed signal may be caused by a defect in the antenna installation, microphonic tubes, or ignition interference.

SECTION III. FUNCTIONING OF PARTS

10. Radio Receiver BC-341-F

a. Referring to the schematic diagram, Figure 2, the ultra high frequency signal (75 megacycles) picked up by the antenna is fed to the input r-f transformer 5 through a concentric transmission line. The ultra high frequency voltage induced in the r-f transformer is impressed on the control grid of Tube VT-153 by means of capacitor 10 and grid resistor 16-1 (grid resistor 16-2 is effectively by-passed at radio frequency by capacitor 29). The ultra high frequency variations of plate current of Tube VT-153 caused by the signal voltage impressed on the control grid produces a radio frequency voltage across r-f choke 7-1 which is impressed on the diode plate by means of coupling capacitors 11-1 and 11-2 and r-f choke 7-2. The advantage of tuned circuit 6-28 is to give the receiver greater selectivity. The radio frequency signal is rectified by the diode. The audio frequency voltage produced across resistor 17 is coupled back to the grid of Tube VT-153 by means of capacitor 13-2 and resistor 16-2. Resistor 16-1 can be considered in series with the control grid when the tube functions as an audio frequency amplifier. The audio frequency variations of plate current flowing through audio choke 8-1 and resistor 22 produce an audio frequency voltage which is impressed on the grid of Tube VT-104 by means of coupling capacitor 13-1 and grid resistor 19. The audio frequency voltage produced across audio choke 8-2 is impressed on the diode plate of Tube VT-104 by means of capacitor 15, and the coil of relay 23 which functions as the diode load. The rectified audio frequency current flowing through the relay coil operates the relay, the contacts of which close the circuit of the radio receiver indicator lamp.

THE WIRING ON THIS BC-341-F IS SURE "HAYWIRE" - I THINK I'LL CLEAN IT UP!
BETTER STICK TO THE ORIGINAL LAYOUT IF YOU WANT IT TO WORK- THAT HIGH FREQUENCY STUFF IS TRICKY!
CONSULT ANOTHER RECEIVER OR PHOTO WHEN REPLACING PARTS OR WIRING IN THE BC-341-F OR BC-357-H. FOLLOW THE ORIGINAL LAYOUT EXACTLY.

b. At ultra high frequencies it is necessary to regard the wiring of the ultra high frequency circuits as an appreciable part of the circuit constants. As an illustration, the lead from pin No. 1 of Tube VT-153 socket to the chassis ground, although less than one inch in length is an inductance, and its actual length and position have considerable effect on the radio receivers sensitivity and stability. Due also to the reflex circuit connections there exists some feed-back which is regenerative. This feed-back tends to cancel out the transit time effect of Tube VT-153 when used as an ultra high frequency amplifier, and results in improved sensitivity and selectivity. The amount of this feed-back depends on the exact length of wiring and by-passing associated with the first tube as well as the circuit constants themselves. For this reason whenever parts are replaced, another receiver or the photographs of the instruction book must be used as reference and the exact lengths and positions of the leads duplicated. Design details which may seem unconventional are essential to the stability of the receiver.

c. One of the requirements of this receiver is that it must be relatively insensitive for use with the 20 watt, 60 cycle modulated marker beacon transmitter of the Army instrument landing system, yet provide maximum sensitivity for use with the 5 watt, 3,000 cycle modulated cone of silence mark-

ers on the civil airways. For this reason the constants of the audio frequency coupling circuits have been chosen to discriminate against the lower audio frequencies and to provide maximum amplification at 3,000 cycles. Coupling capacitors 13-1 and 13-2 have a comparatively low value for this reason. Also, it will be noted that audio choke 8-1 has a very high impedance at 3,000 cycles which causes Tube VT-153 to be very efficient as an audio amplifier at 3,000 cycles. The impedance of audio choke 8-1 is, of course, comparatively low at 60 cycles. However, resistor 22 (6800 ohms) is a part of the plate load, which does not discriminate against the low audio frequencies.

d. The space current (plate current plus screen grid current) of Tube VT-153 flowing through resistor 33 supplies the grid bias for the tube. By-pass capacitor 12-2 is of a comparatively low value. Thus resistor 33 has a slight degenerative effect at audio frequencies.

e. Resistor 20 and capacitor 14 act as a filter circuit in the high voltage supply to Tube VT-153. This filter serves to prevent hash or ripple which might be present in the high voltage supply, from operating the relay. The characteristics of filters 20 and 14 are such as to render negligible the effect of 3 volts of audio ripple in the band 40 CPS to 3,000 CPS in the high voltage supply.

f. The screen grid potential is supplied through resistor 18. Capacitor 12-1 functions as a by-pass for the screen grid circuit.

g. Compensation for change in temperature is provided by capacitors 10, 11-1 and 11-2, which are of the temperature compensating ceramic type.

h. Both Tube VT-153 and Tube VT-104 have 12.6 volt heaters. These heaters are connected in parallel in this set.

i. The relay designated as part 23 in the schematic diagram, is shown in Figure 9. The closing current is 0.4 ma. Release occurs when the current drops to 0.2 ma. The adjustment should always be made carefully in accordance with the instructions given in paragraph 15, under Maintenance. The armature travel is determined by screws S_1 and S_2 which should be adjusted very carefully. The tension on the armature which pivots about point O is regulated by a third set screw S_3 acting upon the spring SP. A_1 and A_2 are the terminals for the relay coil windings. Terminals B_1 and B_2 are the terminals for the secondary circuit which the relay closes to operate the marker beacon indicator lamp. Terminal B_3 is not used.

j. Tuning adjustments on the receiver are made by varying capacitors 9 and 28. These are marked "ANT" and "DET" respectively on the front panel. The positions of these capacitors are shown in Figure 3.

11. Vacuum Tubes

a. Two tubes are employed in Radio Receiver BC-341-F. The function and characteristics of the vacuum tubes required appear in the table below:

Tube	VT-153	VT-104
Function	Pentode r-f Amp. Diode Det. First a-f Amp.	2nd Audio Amp. Diode Rect.
Heater v	12.6	12.6
Heater a	.15	.15
Esg. v	125 max	—
Ep v	250 max	250 max
Ecg v	—3	—2
Ip ma	9.0	0.9
Isg ma	2.3	—
Mu	730	100
Rp ohms	650,000 normal	91,000
Gm umhos	1,125	1,100

NOTE: These data are the characteristics of the tubes as listed commercially, and except for heater voltage do not necessarily indicate the actual values in operation in the equipment.

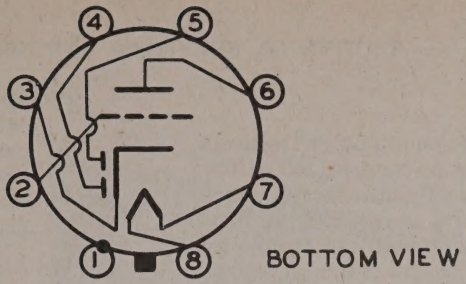


Figure 4 — TUBE VT-104, DUPLEX-DIODE TRIODE

(1) METAL SHELL CONNECTION
(2) CONTROL GRID
(3) CATHODE
(4)(5) DIODE PLATES
(6) PLATE
(7)(8) HEATER

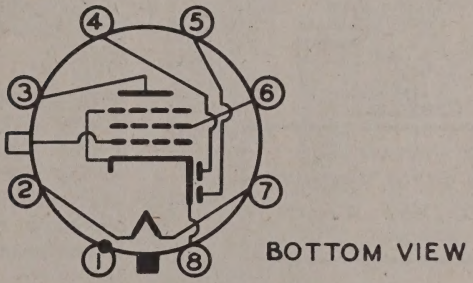


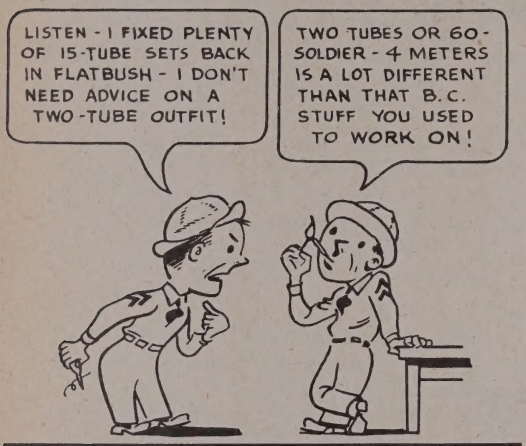
Figure 5 — TUBE VT-153, DUPLEX-DIODE PENTODE

(1) METAL SHELL CONNECTION
(2)(7) HEATER
CONTROL GRID CONNECTED TO CAP OF TUBE
(3) PLATE
(4)(5) DIODE PLATES
(6) SCREEN GRID
(8) CATHODE

SECTION IV. SERVICING AND REPAIR

12. Maintenance

Radio Receiver BC-341-F, an ultra-high frequency device, imposes greater restrictions on maintenance and requires more particular servicing than do ordinary tuned radio frequency receivers. However, since the receiver is relatively simple, the precautions to be observed are few though stringent. The maintenance of the radio frequency portion of this receiver demands care. At ultra-high


LISTEN - I FIXED PLENTY OF 15-TUBE SETS BACK IN FLATBUSH - I DON'T NEED ADVICE ON A TWO-TUBE OUTFIT!
TWO TUBES OR 60 - SOLDIER - 4 METERS IS A LOT DIFFERENT THAN THAT B.C. STUFF YOU USED TO WORK ON!
THE RADIO FREQUENCY CIRCUITS OF THE BC-341-F AND BC-357-H REQUIRE MORE THAN ORDINARY CARE BOTH IN MAINTENANCE AND WIRING.

frequencies the length of connection leads and the placement of parts such as coils and capacitors are extremely important. Care should therefore be exercised in replacing parts or leads. The photographs in Figures 6 and 7 must be carefully followed or a standard receiver should be referred to. The circuits connected to Tube VT-153 are the only critical ones in this respect.

13. Service Inspection

a. A periodic inspection should be made as follows:

(1) Tubes should be checked on the best available type of tube tester, preferably on equipment capable of determining the characteristics listed under paragraph 11.

(2) Check the relay closing and release currents according to the procedure outlined in paragraph 10-a of this section. Make any necessary relay adjustments by following the instructions of paragraph 10-b, of the same section.

(3) Align the receiver as indicated in this section, whenever tubes are replaced, or the installation of the antenna structure, including the transmission line is modified or repaired. Always install receiver chassis in its case when the final alignment of the receiver circuits is made.

(4) A flight test should be made over Army instrument landing markers to make sure that the radio receiver is functioning properly when receiving signals from these transmitters.

14. Continuity Tests

a. First remove Plug PL-108 and tubes from their sockets before making continuity tests.

b. Resistors may be checked at their terminals since none are shunted by other components excepting capacitors. Failure to obtain values as designated on the circuit label indicates a defect in the resistor or breakdown of the adjacent capacitor. Adjacent capacitors should be checked immediately for short circuits in the event of failure to obtain correct ohmmeter readings for the resistors.

c. Capacitors should all have resistance values on the order of 10,000 megohms at room temperature — although values as low as 1,000 megohms are satisfactory for service. Measurements across the terminals of all fixed capacitors with the exception of 10, 11-2, 12-1, 13-2 and 31-1 should indicate resistance values beyond the upper limit of the ohmmeter on its highest range. A small kick of the ohmmeter needle when first connecting to the capacitor terminals is due to the surge of charging current. The steady value is the indication of resistance. The kick is an indication of the size of the capacitor and will be

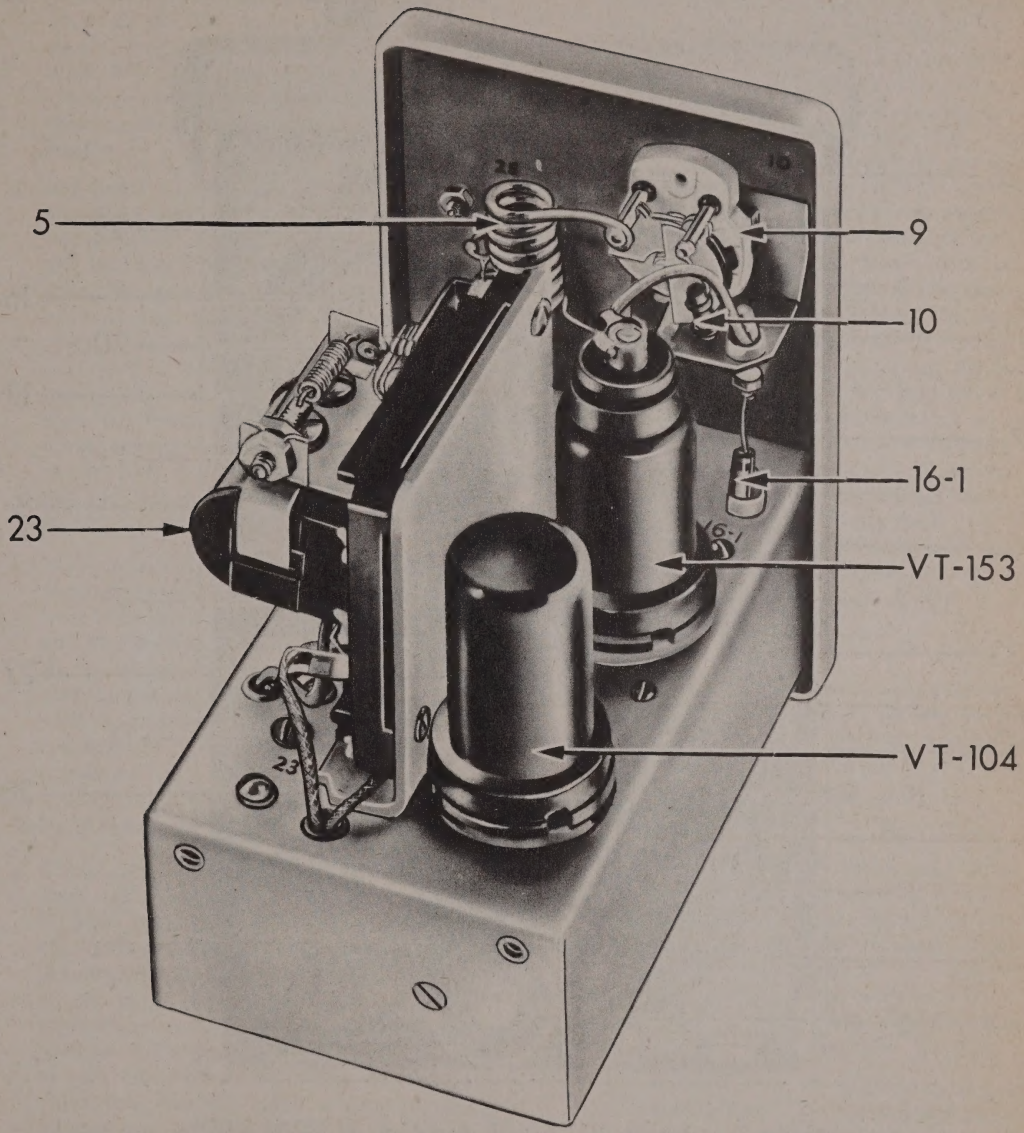


Figure 6 — RADIO RECEIVER BC-341-F, TOP VIEW

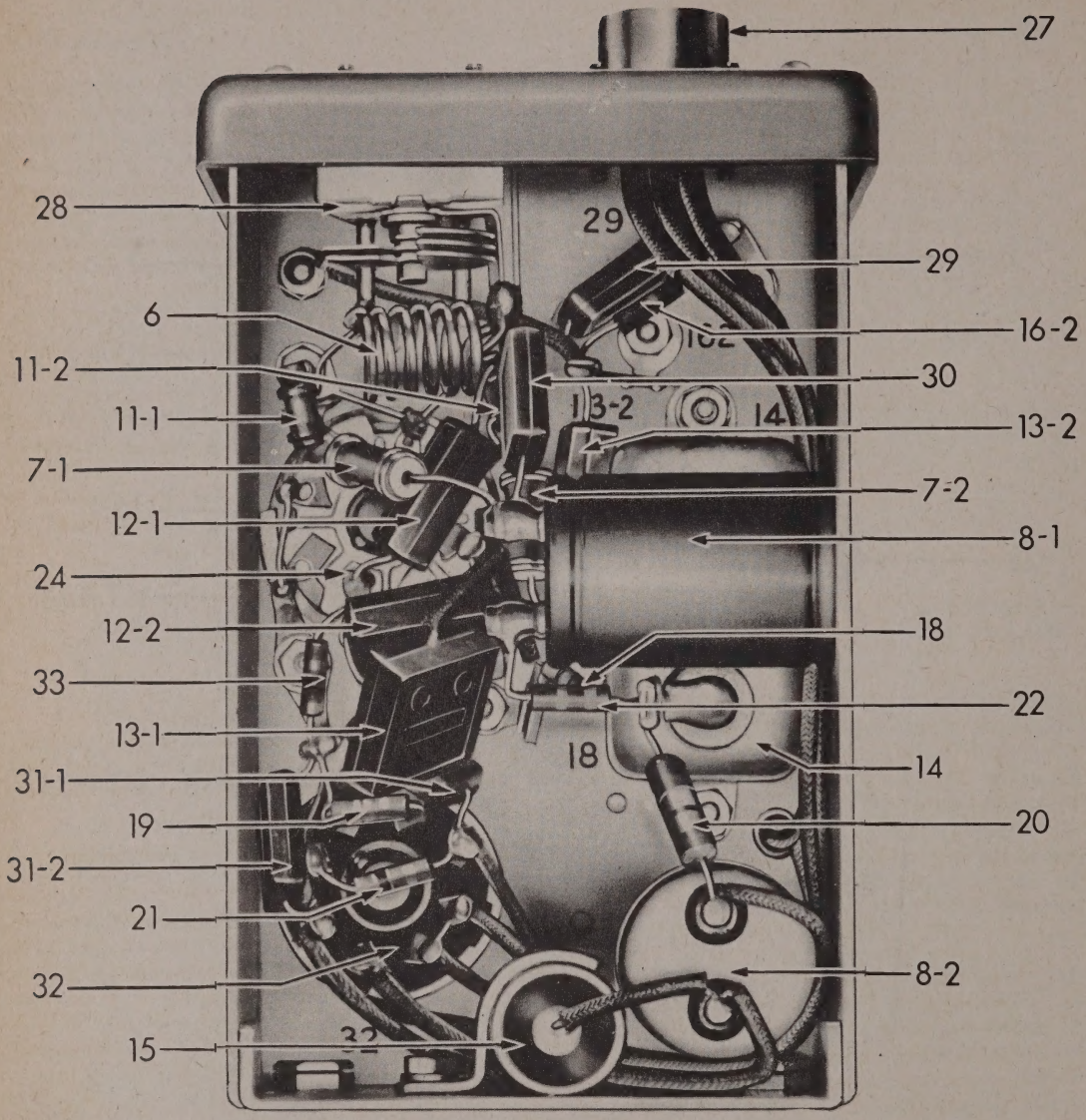


Figure 7 — RADIO RECEIVER BC-341-F, BOTTOM VIEW

observed only with values on the order of .01 mfd or larger and indicates that the capacitor is not open circuited. Capacitors 10, 11-2, 29, 12-1, 13-2 and 31-1 will measure 2 megohms, 0.56 megohms, 1 megohm, 560 ohms, 1.5 megohms and 1000 ohms respectively when measured across their terminals due to the shunting by resistors.

d. R-f input transformer 5 and inductor 6 should be inspected visually to insure that the soldered connections are satisfactory, and that the spacing between turns is uniform. The grid leads to Tube VT-153 should be examined for broken strands and replaced if necessary. The grid clip should be examined to insure a firm grip on the grid cap of the tube. R-f chokes 7-1 and 7-2 may be checked by direct measurement across terminals. They should measure approximately 3.5 ohms each. Audio chokes 8-1 and 8-2 should show a d-c resistance of 1600 ohms each.

e. Relay continuity tests include resistance measurement of the coil which has a nominal value of approximately 13,000 ohms and may be measured at terminals A_1 and A_2 as shown in Figure 10. Contact resistance should be measured between terminals B_1 and B_2 and be negligible when the contacts are closed by light pressure on the armature.

15. Relay Adjustment

a. Check relay by the following procedure: Turn radio compass on and wait for tubes to heat. Connect Test Indicator BE-67 to the radio receiver by means of the cord provided for that purpose. Hold the switch on the panel of the test indicator in the momentary contact or "ADJUST RELAY" position while the control knob is turned to vary the relay current. The current required to close the relay is normally 0.4 milliampere. A deviation of 10 percent is permissible. As the current is reduced, the relay releases at 0.2 milliampere. A deviation of 10 percent in the release current is permissible. If indicator lamp fails to light, remove receiver from case, check lamp circuit and relay contacts. Clean latter if necessary.

b. Readjustment of the relay is accomplished as follows: Insert a sheet of paper of 2 or 3 mils thickness between the armature and relay coil pole pieces. (See Figure 9.) Release screw S_1 and exert a slight pressure on the armature directly above the pole piece. Turn Screw S_1 until contact is just made and indicator light goes "ON." Lock screw S_1 in place, compensating for effect of lash in threads. Still exerting very light pressure against the armature, make sure that the paper can be withdrawn without excessive rubbing. This insures that there is no flexing of the armature and that the air gap is 2 or 3 mils. Adjust the tension of the armature spring SP by means of screw S_3 until release occurs at 0.2 milliampere of relay current. Lock screw S_3. Screw S_2 should now be adjusted so that the relay closing current is 0.4 milliampere. A deviation of plus or minus 10 percent is allowable for both closing and release currents. However, it is important that the difference between the two should not be less than 0.20 milliamperes for best performance in service.

16. Inductances

a. There are four r-f inductances employed in Radio Receiver BC-341-F, bearing designations 5, 6, 7-1, 7-2 on the circuit label. The following table indicates the functions and dimensions of these coils:

Inductance	Use	Description
5	Radio Frequency Input Transformer	8 turns #14 B & S gauge solid tinned copper spaced to cover approximately 1". Tapped at ½ turn from end with #20 B & S gauge solid tinned copper wire ½" O.D.
6	Detector Tuning Coil	5 ⅞ turns #14 gauge solid tinned copper spaced to cover $1\frac{9}{32}$" ½" O.D.
7-1 7-2	Radio Frequency Choke	88 turns enameled copper wire close wound on $\frac{7}{32}$" ceramic form.

b. The a-f inductors employed in Radio Receiver BC-341-F are two in number, bear-

ing designations 8-1 and 8-2 on the circuit label. These inductors are plate chokes for Tubes VT-153 and VT-104 respectively. The manufacturer's rating of these inductances is 23 henries with 3 ma d-c flowing through them.

17. Receiver Sensitivity Measurements

a. The sensitivity of the receiver is measured by the application of a 75 megacycle signal through a 75 ohm dummy antenna load from a signal generator such as Ferris Microvolter Model 18-C with provision for external modulation. The dummy antenna may be an IRC type BT-½, 75 ohm resistor. The resistor must be connected by the shortest length of lead to the ANT jack 25, preferably by means of a Jones type 101-D plug. A 30 percent modulated signal is required for the sensitivity measurement. The normal sensitivity of Radio Receiver BC-341-F varies between 1250 and 2250 microvolts input at 3000 cps (30 percent modulation). This is the test input which is required to produce a .4 ma standard output from the radio receiver. The performance of the radio receiver for instrument landing with the Army marker beacon transmitters, Marker Beacon Projector A-1 and Radio Transmitter BC-302 should be judged by the sensitivity of the receiver with a 60 cps modulated signal. The normal sensitivity of the receiver for 60 cps plate modulated signal varies between 15,000 and 40,000 microvolts measured as outlined above. When 60 cps modulation is employed, the relay closing current, as averaged by the direct current meter, will be found to be lower than 0.4 ma. For purposes of measurement, however, 0.4 milliampere is considered standard. The relay should not operate with less than a 15,000 microvolt, 60 cycle modulated signal applied to receiver. With three volts audio frequency (40 cycles to 3000 cycles) applied in series with the 220 volt supply the relay current should not be greater than .1 ma and will normally be about .05 ma.

b. Selectivity should measure as follows:

(1) Tune the receiver accurately to resonance at 75 megacycles, using 30 percent modulation at 3000 cps. Adjust the signal input, employing a 75 ohm dummy antenna, to the level required for an output of 0.4 ma. This value should indicate normal receiver sensitivity.

(2) Set the signal generator frequency at about 70 megacycles and increase the input level two-fold.

(3) Increase frequency slowly until the receiver output is again 0.4 milliampere. Record the frequency at this point.

(4) Continue to increase the frequency beyond resonance until the receiver output falls to the standard value of 0.4 milliampere. Record the frequency at this point.

(5) The difference between values recorded in (3) and (4) is the band width at two-fold (6 db) input.

(6) Repeat the above procedure but increase the signal level ten-fold in st (2). The band width now obtained for a ten-fold (20 db) increase in signal level.

(7) The measured values of band width should be within 40 percent of the following values, and will normally be less for receivers of higher sensitivity due to variation in the regenerative effects of the amplifier Tube VT-153:

Input	Band width
2 x value at resonance (6 db)	**1.00 megacycle**
10 x value at resonance (20 db)	**4.00 megacycles**

18. Interstage Measurements

a. Audio frequency measurements are given in the following table which indicates the nature and value of the signal required to produce a receiver output current of 0.4 milliampere and to the point of application of the test voltage. The test voltage is given with respect to chassis. Shielded leads, and an isolating condenser of 0.1 mf should be used:

Point of Application	Nature of Signal (Cycles per Second)	Volts Required For 0.4 ma.
Grid of Tube VT-104	3000	.48
	60	3.4
Plate of Tube VT-153	3000	.54
	60	6.4
Grid of Tube VT-153	3000	.02
	60	2.4

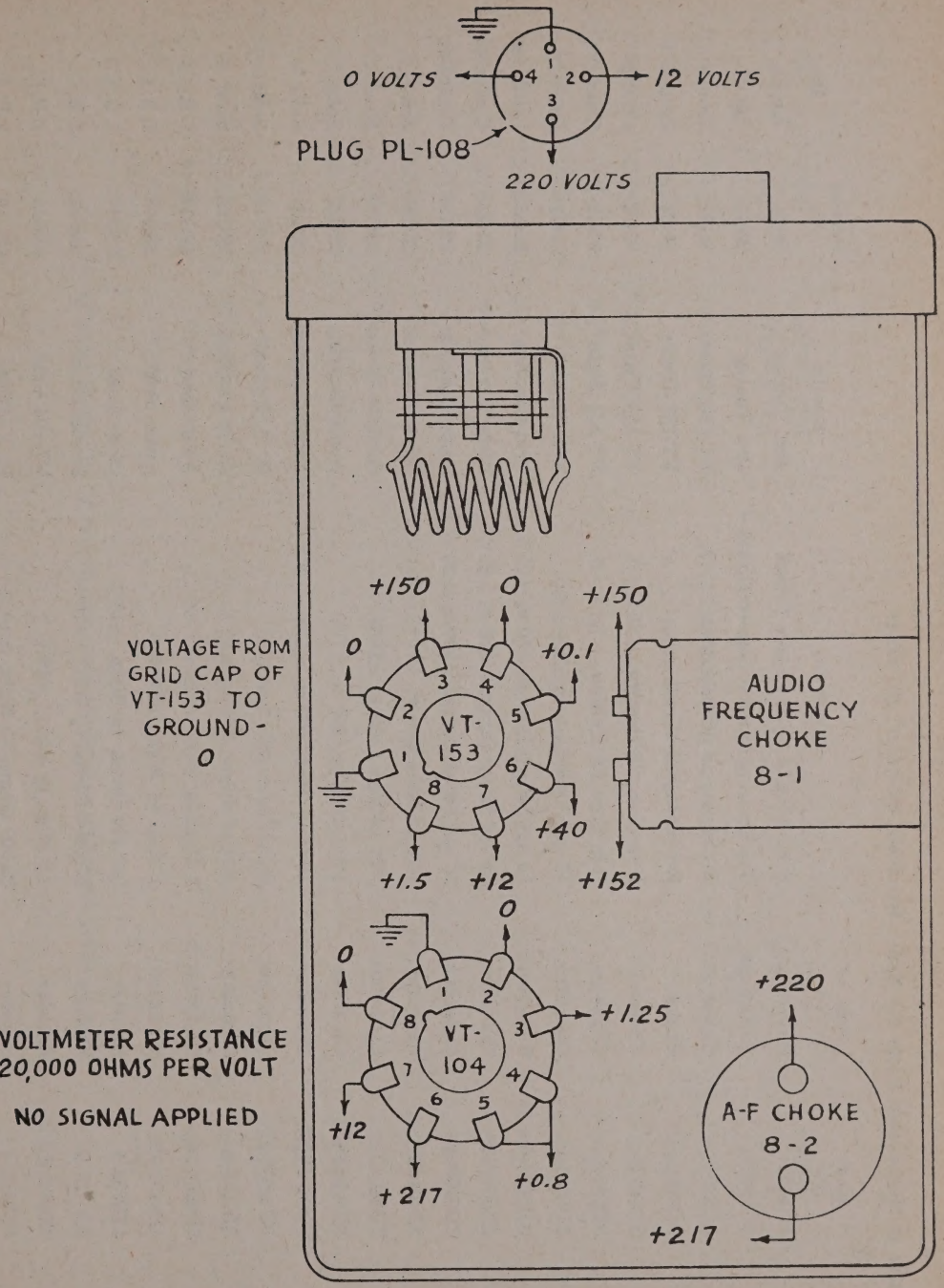


Figure 8 — TERMINAL-TO-GROUND VOLTAGE CHART, RADIO RECEIVER BC-341-F

19. Table of Replaceable Parts for Radio Receivers BC-341-F, BC-357-H

Ref. No.	Stock No.	Name of Part	Description	Function	Drawing No.	Mfr.
5	3C1067	Inductance	8 Turns #14 Solid Copper-Tinned	Ant. Tuning	20G6	Zenith
6	3C1067-1	Inductance	5⅞ Turns #14 Solid Copper-Tinned	Det. Tuning	20G1	Zenith
7-1	3C339	Choke	R-f choke, 16 Microhenries	VT-153 Plate	5G67	Zenith
7-2	3C339	Choke	R-f choke, 16 Microhenries	VT-153 Diode	5G67	Zenith
8-1	3C343-2	Choke	Iron Core, 23 Henries, +30%—0	VT-153 Plate	95G2	Chicago
8-2	3C343-2	Choke	Iron Core, 23 Henries, +30%—0	VT-104 Plate	95G2	Chicago
9	3D9017-1	Capacitor	17 uuf Variable, Air Dielectric	Ant. Tuning	22G10	Oak
10	3D9075-6	Capacitor	15 uuf Silver Ceramic, 500 v, ±20%	Grid Coupling	22G25	Centralab
11-1	3D9050-48	Capacitor	50 uuf Silver Ceramic, 500 v, ±20%	Plate Coupling	22G24	Centralab
11-2	3D9050-48	Capacitor	50 uuf Silver Ceramic, 500 v, ±20%	Diode Coupling	22G24	Centralab
12-1	3DA4-21	Capacitor	.004 uf Mica, 500 v, ±10%	Screen By-pass	22G19	Solar
12-2	3DA4-21	Capacitor	.004 uf Mica, 500 v, ±10%	Cathode By-pass	22G19	Solar
13-1	3DA1-500-3	Capacitor	.0015 uf Mica, 500 v, ±10%	Audio Coupling	22G21	Solar
13-2	3DA1-500-3	Capacitor	.0015 uf Mica, 500 v, ±10%	Audio Coupling	22G21	Solar
14	3DA500-51	Capacitor	.5 uf Paper, 400 v, ±10%	H. V. By-pass	22G13	Solar
15	3DA34-1	Capacitor	.034 uf Paper, 600 v, ±10%	Audio Coupling	22G22	Solar
16-1	3Z6801-16	Resistor	1 Meg. ¼ Watt, ±20%	Audio Grid	63G18	I. R. C.
16-2	3Z6801-16	Resistor	1 Meg. ¼ Watt, ±20%	Audio Grid	63G18	I. R. C.
17	3Z6756-4	Resistor	560,000 Ohms, ¼ Watt, ±10%	Diode Load	63G17	I. R. C.
18	3Z6727-5	Resistor	270,000 Ohms, ¼ Watt, ±10%	Screen Supply	63G21	I. R. C.
19	3Z6802A2-2	Resistor	2.2 Meg. ¼ Watt, ±10%	VT-104 Grid	63G19	I. R. C.
20	3Z6622-4	Resistor	22,000 Ohms, ½ Watt, ±10%	H. V. Filter	63G15	I. R. C.
21	3Z6010-26	Resistor	1000 Ohms, ¼ Watt, ±10%	VT-104 Cathode	63G12	I. R. C.

Table of Replaceable Parts for Radio Receivers BC-341-F, BC-357-H (Continued)

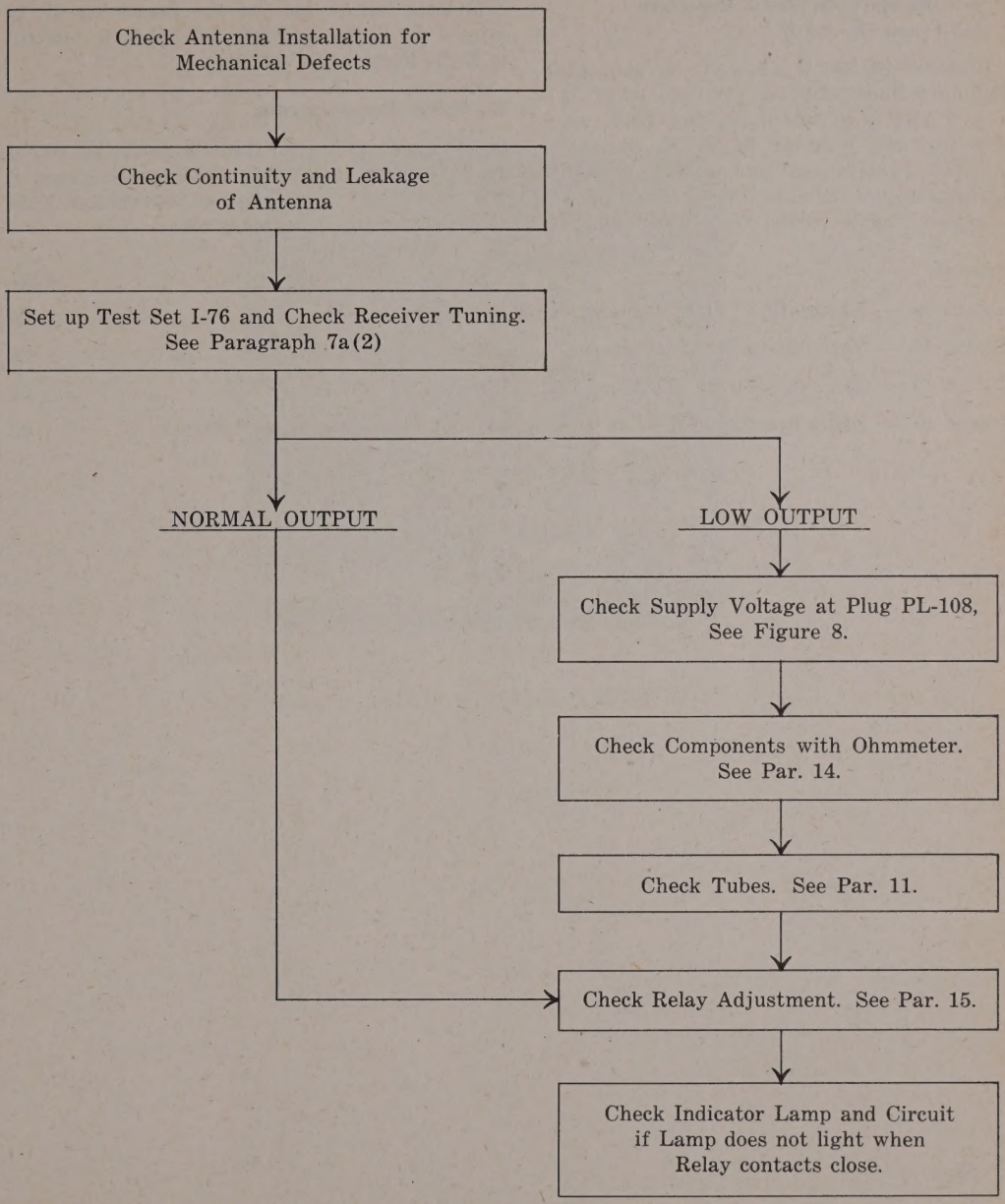
Ref. No.	Stock No.	Name of Part	Description	Function	Drawing No.	Mfr.
22	3Z6568-4	Resistor	6800 Ohms, ¼ Watt, ±10%	Audio Plate	63G14	I. R. C.
23	2Z7703	Relay	Control Relay BK-35	Indicator Lamp	195G10	G. M. Lab.
24	2Z8761.5	Socket	Octal, 8 Contact	VT-153 Socket	78G4	Amphenol
25	2Z1583	Jack	Single Contact	Ant. Input	SG125	Jones
26	2Z5581-2	Jack	Closed Circuit	Relay Test	SG108	Mallory
27	2Z8788	Socket	Plug Receptacle (50-88)	For Plug PL-108	SG118	Kellogg
28	3D9017-2	Capacitor	17 uuf Variable, Air Dielectric	Det. Tuning	22G11	Oak
29	3D9150-10	Capacitor	150 uuf Mica, 500 v, ±20%	R-f By-pass	22G41	Solar
30	3C9075-3	Capacitor	75 uuf Mica, 500 v, ±10%	Audio By-pass	22G26	Cornell
31-1	3D9500-55	Capacitor	500 uuf Mica, 500 v, ±20%	Heater Circuit	22G27	Solar
31-2	3D9500-55	Capacitor	500 uuf Mica, 500 v, ±20%	R-f By-pass	22G27	Solar
32	2Z8795-8	Socket	Octal, 8 Contact	VT-104 Socket	78G2	Amphenol
33	3Z5356	Resistor	560 Ohms, ½ Watt, ±10%	VT-153 Cathode	63G22	I. R. C.
34	2Z3404	Cap	Relay Jack Cover	Dust Cap	SG64	Zenith
35	2C4341F/B1	Bushing and Terminal	Isolantite Bushing & Terminal	Feed Through	SG116	Zenith
36		Grid Cap	Grid Contact Clip	For VT-153	19G3	Zierick
	6N6515	Shield	Rubber Sleeve	Dust Shield	199G3	Atlantic

20. Manufacturers' Names and Addresses

Code	Name of Manufacturer	Address
ZENITH	Zenith Radio Corporation	6001 Dickens Ave., Chicago, Ill.
OAK	Oak Mfg. Co.	711 W. Lake St., Chicago, Ill.
CENTRALAB	Centralab	900 Keefe Ave., Milwaukee, Wis.
SOLAR	Solar Manufacturing Co.	Bayonne, N. J.
AMPHENOL	American Phenolic Co.	500 S. Throop St., Chicago, Ill.
I. R. C.	International Resistance Co.	401 N. Broad St., Philadelphia, Pa.
ZIERICK	Zierick Mfg. Co.	385 Girard Ave., New York, N. Y.
G. M. LAB.	G. M. Laboratories, Inc.	4326 N. Knox Ave., Chicago, Ill.
CHICAGO	Chicago Transformer Corp.	3501 Addison St., Chicago, Ill.
KELLOGG	Kellogg Switchboard & Supply	6650 So. Cicero Ave., Chicago, Ill.
CORNELL DUBILIER	Cornell-Dubilier Corp.	4377 Bronx Blvd., New York, N. Y.
ATLANTIC	Atlantic India Rubber Works	1453 W. Van Buren St., Chicago, Ill.
MALLORY	P. R. Mallory & Co.	Indianapolis, Ind.
JONES	Howard B. Jones Co.	2300 W. Wabansia Ave., Chicago, Ill.

21. Trouble Location and Remedy Chart

EQUIPMENT NOT SATISFACTORY IN FLIGHT


Check Antenna Installation for Mechanical Defects
Check Continuity and Leakage of Antenna
Set up Test Set I-76 and Check Receiver Tuning. See Paragraph 7a(2)
NORMAL OUTPUT
LOW OUTPUT
Check Supply Voltage at Plug PL-108, See Figure 8.
Check Components with Ohmmeter. See Par. 14.
Check Tubes. See Par. 11.
Check Relay Adjustment. See Par. 15.
Check Indicator Lamp and Circuit if Lamp does not light when Relay contacts close.

PART B

RADIO RECEIVER BC-357-H

22. Differences Between Radio Receivers BC-341-F and BC-357-H

Radio Receiver BC-357-H (24-volt) is identical with Radio Receiver BC-341-F (12-volt) which is treated in PART A of this instruction book, except that in Radio Receiver BC-357-H, the two vacuum tube heaters are connected in series, making the receiver suitable for operation on a 24-volt heater supply. Radio frequency by-pass 31-2 from the + side of the heater circuit to ground in Radio Receiver BC-341-F is omitted in Radio Receiver BC-341-H.

23. Power Requirements

Power requirements for Radio Receiver BC-357-H are 0.15 amps at 24 volts and 7 milliamperes at 220 volts. There is also a small low voltage drain furnished by the indicator lamp.

24. Diagrams

Page

Figure 12 — Schematic Circuit Diagram, Radio Receiver BC-357-H 25

Figure 13 — Terminal-to-Ground Voltage Chart, Radio Receiver BC-357-H 26

Figure 14 — Practical Wiring Diagram, Radio Receiver BC-357-H 27

Figure 15 — Radio Receivers BC-341-F and BC-357-H, Outline Dimensional Sketch. 28

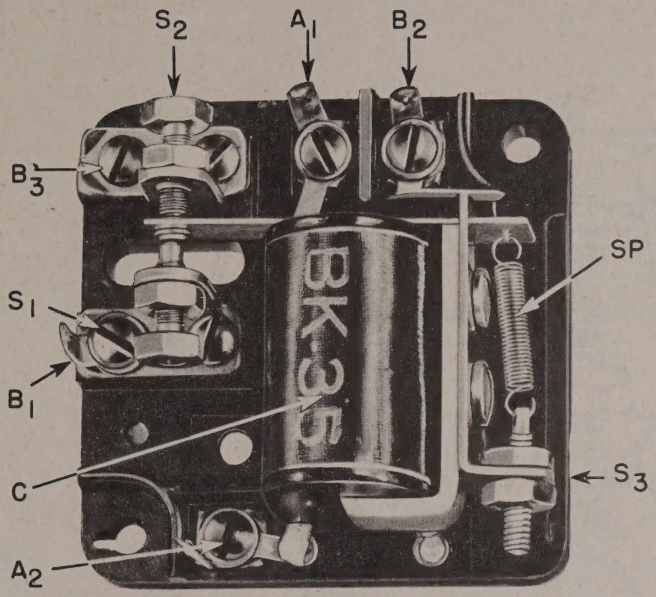


Figure 9 — RELAY BK-35, FRONT VIEW

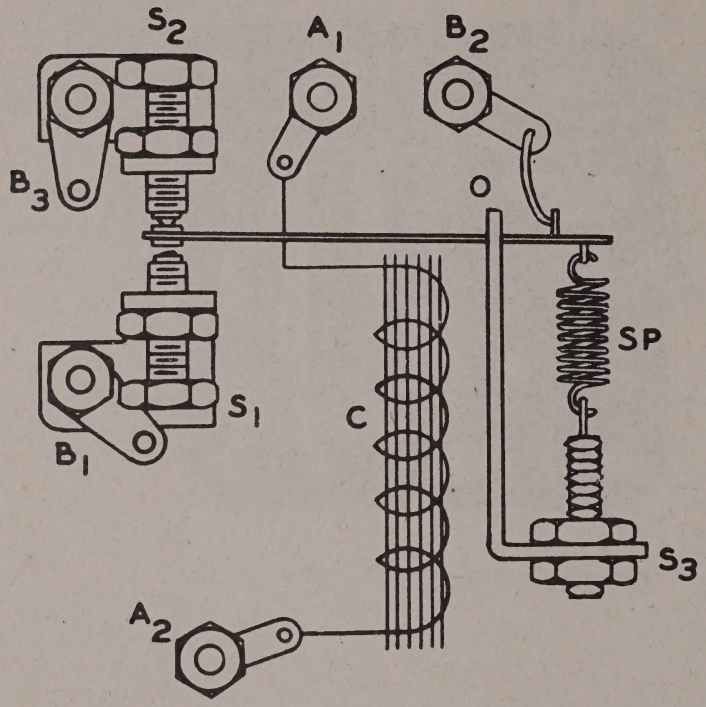


Figure 10 — RELAY BK-35, FUNCTIONAL DIAGRAM

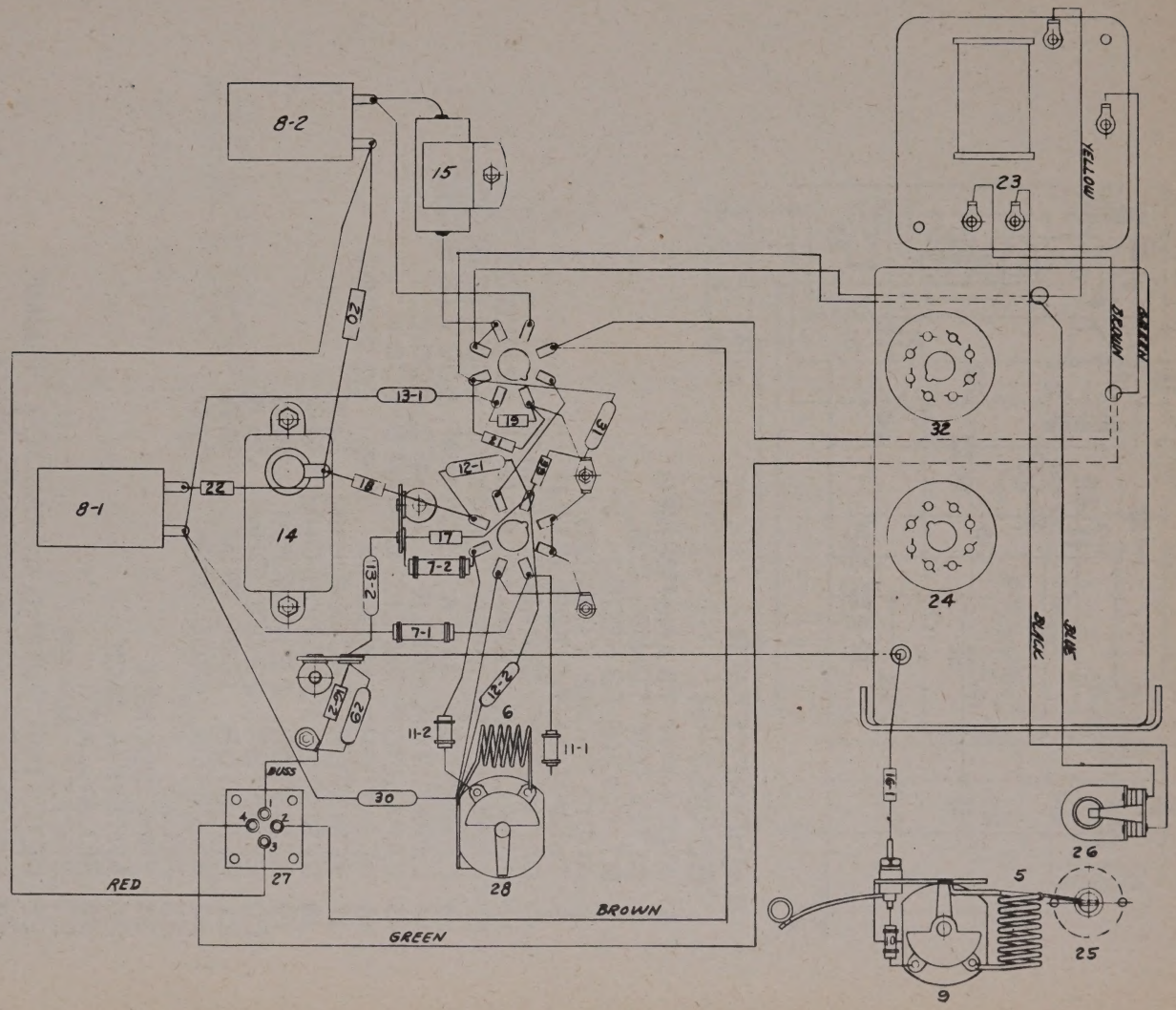
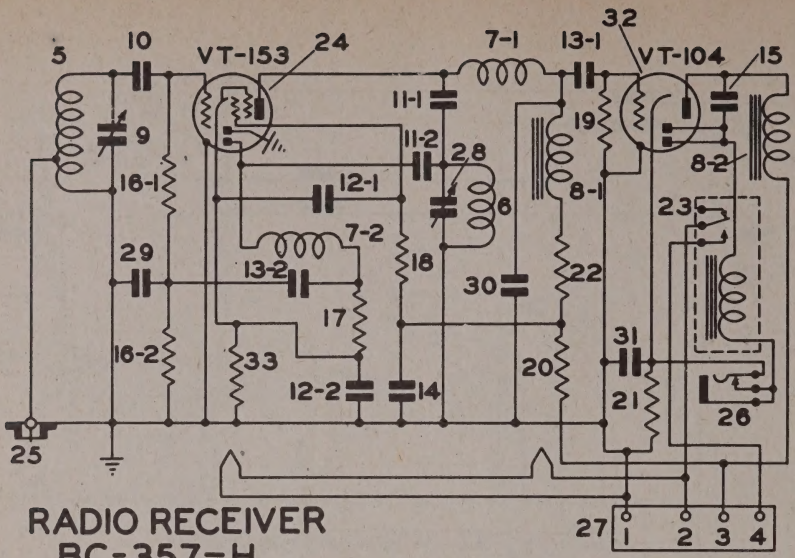


Figure 11 — PRACTICAL WIRING DIAGRAM, RADIO RECEIVER BC-341-F



RADIO RECEIVER
BC-357-H

5 ANT. INPUT TRANSFORMER
6 DETECTOR TUNING COIL
7 R.F. CHOKE (2 REQ'D.)
8 AUDIO CHOKE (2 REQ'D.)
9 TUNING CAPACITOR, 17 MMF.
10 CAPACITOR, CERAMIC 15 MMF.
11 CAPACITOR, CERAMIC 50 MMF. (2 REQ'D.)
12 CAPACITOR, MICA .004 MFD. 500 V. (2 REQ'D.)
13 CAPACITOR, MICA 1500 MMF. 500 V. (2 REQ'D.)
14 CAPACITOR, PAPER 0.5 MFD. 400 V.
15 CAPACITOR, PAPER .034 MFD. 600 V.
16 RESISTOR, 1 MEGOHM 1/4 W. (2 REQ'D.)
17 RESISTOR, 560,000 OHM 1/4 W.
18 RESISTOR, 270,000 OHM 1/4 W.
19 RESISTOR, 2.2 MEGOHM 1/4 W.
20 RESISTOR, 22,000 OHM 1/2 W.
21 RESISTOR, 1000 OHM 1/4 W.
22 RESISTOR, 6800 OHM 1/4 W.
23 RELAY
24 TUBE SOCKET
25 ANTENNA JACK
26 RELAY JACK
27 SOCKET SO-88
28 DETECTOR TUNING CAPACITOR, 17 MMF.
29 CAPACITOR, MICA 150 MMF. 500 V.
30 CAPACITOR, MICA 75 MMF. 500 V.
31 CAPACITOR, MICA 500 MMF. 500 V.
32 TUBE SOCKET
33 RESISTOR, 560 OHM 1/4 W.

Figure 12 — SCHEMATIC CIRCUIT DIAGRAM, BC-357-H

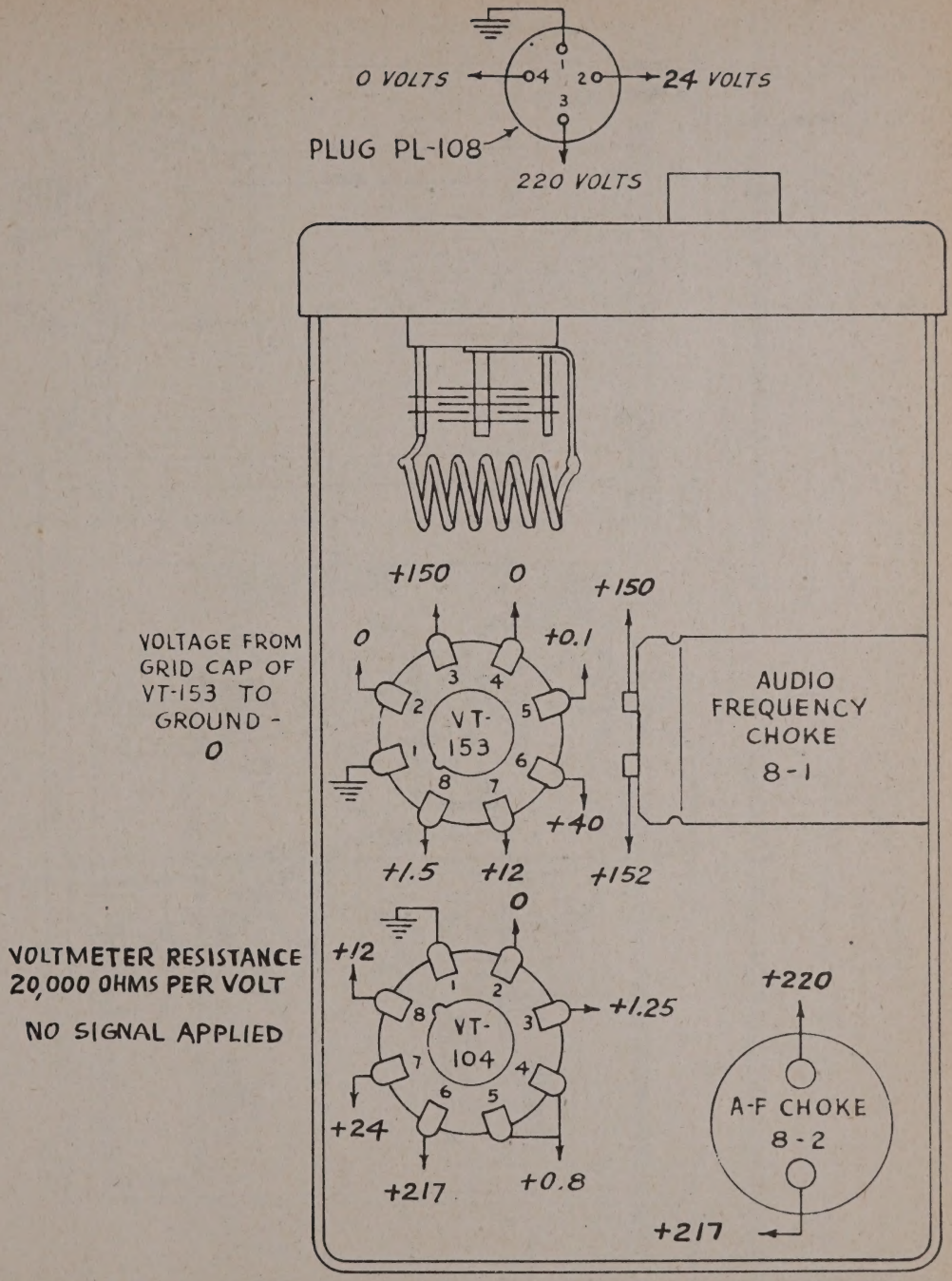


Figure 13 — TERMINAL-TO-GROUND VOLTAGE CHART, RADIO RECEIVER BC-357-H

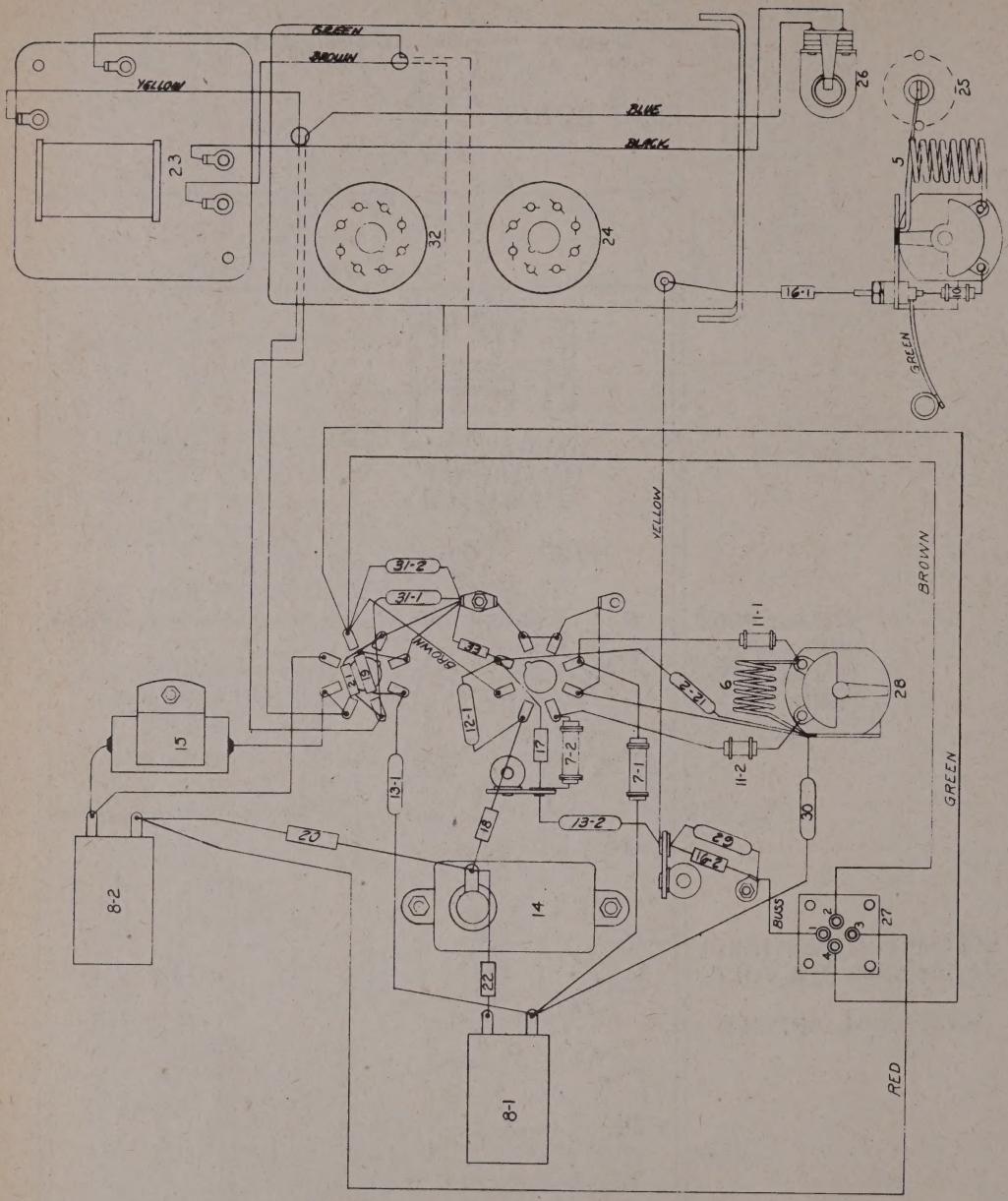


Figure 14 — PRACTICAL WIRING DIAGRAM, RADIO RECEIVER BC-357-H

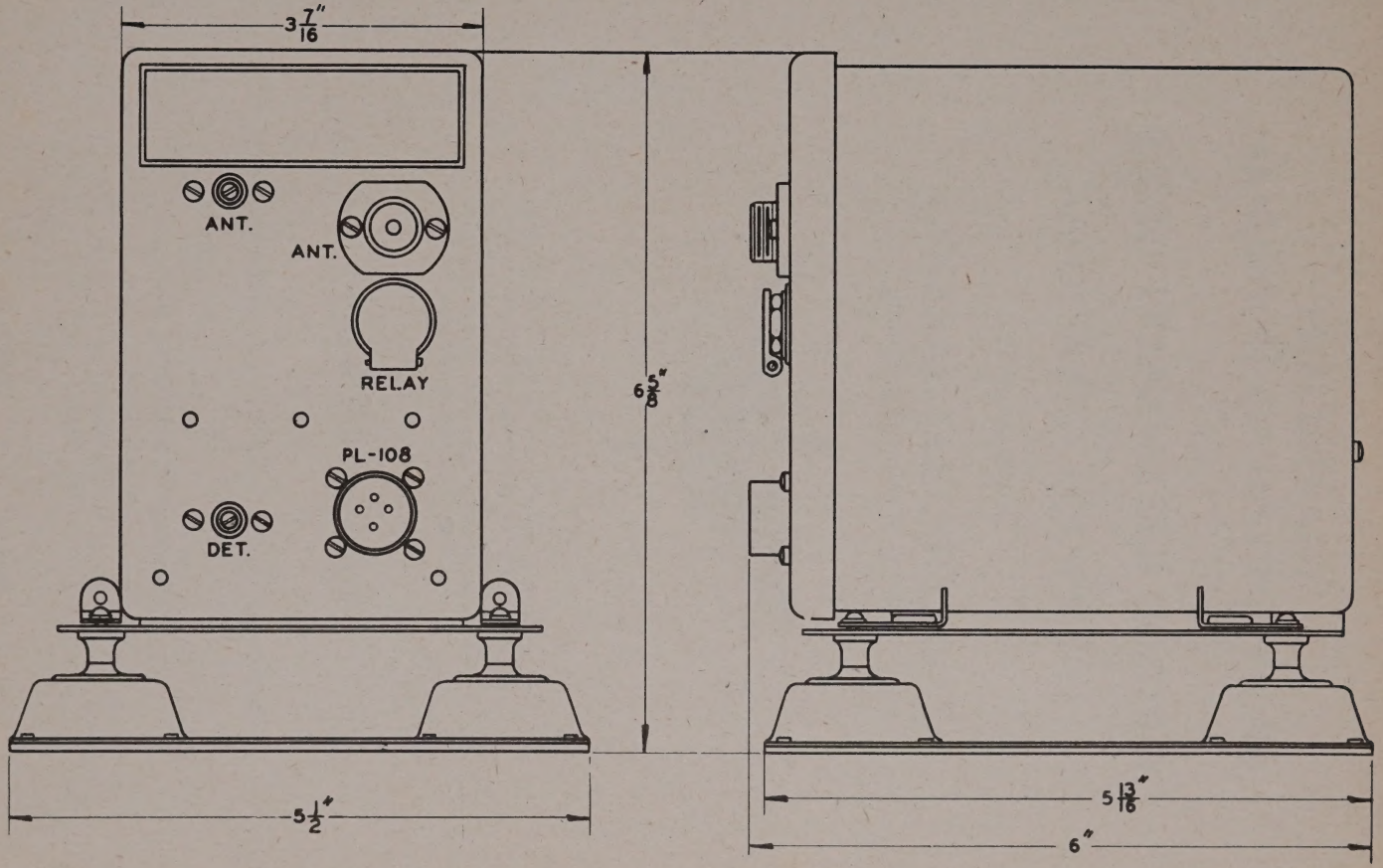


Figure 15 — RADIO RECEIVERS BC-341-F AND BC-357-H, OUTLINE DIMENSIONAL SKETCH.

TECHNICAL ORDER
No. 08-10-66

PRELIMINARY HANDBOOK OF INSTRUCTIONS

FOR

RADIO TRANSMITTER BC-375-D

AND

ASSOCIATED EQUIPMENT

Manufactured By

GENERAL ELECTRIC CO.

BRIDGEPORT, CONNECTICUT

NOTICE: This document contains information affecting the National Defense of the United States within the meaning of the Espionage Act, 50 U. S. C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

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WRIGHT FIELD

DAYTON, OHIO

APRIL 10, 1942

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MARCH 11, 1944 6,000

SAFETY TO HUMAN LIFE

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGE SUPPLY ON. DO NOT COMPLETE OR MAINTAIN ANY CONNECTION BETWEEN TRANSMITTER AND DYNAMOTOR UNIT UNLESS ALL UNUSED SOCKETS ON THE TRANSMITTER ARE COVERED BY SOCKET CAPS WITH CATCHES PROPERLY SNAPPED IN PLACE.

KEEP AWAY FROM LIVE CIRCUITS

1. Under no circumstances should any person be permitted to operate the dynamotor with fuse box cover or end bells removed; or to replace fuses with power on; or to remove, place, or handle removed plugs with the dynamotor running.

2. Under no circumstances adjust circuits or service the equipment when the carrier is keyed off only. The transmitter uses a grid-bias keying circuit, which does not remove high voltage when the key is open.

DO NOT OPERATE THE EQUIPMENT WITH SHIELDS REMOVED

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LIST OF DRAWINGS

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W-7350805—Radio Transmitter BC-375-D, Connection Diagram

T-7661418—Radio Transmitter BC-375-D, Dimensions and Weights

T-7661308—Transmitter Tuning Units, Schematic Diagram

P-7763035—Transmitter Tuning Unit TU-5-B, Connection Diagram

P-7763036—Transmitter Tuning Unit TU-6-B Connection Diagram

P-7763037—Transmitter Tuning Unit TU-7-B, Connection Diagram

P-7763038—Transmitter Tuning Unit TU-8-B, Connection Diagram

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P-7763040—Transmitter Tuning Unit TU-10-B, Connection Diagram

P-7763042—Transmitter Tuning Unit TU-22-B, Connection Diagram

M-7462842—Case CS-48, Dimensions and Weights

P-7762968—Dynamotor Unit PE-73-C, Connection Diagram

T-7660378—Dynamotor Unit PE-73-C, Dimensions and Weight

M-7462823—Antenna Tuning Unit BC-306-A, Connection Diagram

P-7763324—Antenna Tuning Unit BC-306-A, Dimensions and Weight

M-7462838—Mounting FT-115-B, Dimensions and Weight

I. GENERAL DESCRIPTION OF COMPLETE EQUIPMENT

Radio Transmitter BC-375-D with its associated equipment is designed for aircraft and other applications requiring a medium power equipment with the characteristics of strength, light weight, flexibility and portability. The equipment is designed to provide communication by voice, tone, or continuous wave telegraph over the frequency range of 150 to 12,500 kilocycles. However, only the frequencies covered by the Transmitter Tuning Units listed below are available for use with this equipment:

1. TU-5-B 1500–3000 Kc
2. TU-6-B 3000–4500 Kc
3. TU-7-B 4500–6200 Kc
4. TU-8-B 6200–7700 Kc
5. TU-9-B 7700–10,000 Kc
6. TU-10-B 10,000–12,500 Kc
7. TU-22-B 350–650 Kc

Suitable tuning equipment is provided in the radio transmitter to permit operation into a wide range of antennas over most of the frequency range. Antenna Tuning Unit BC-306-A may be used to extend the range of antenna tuning for frequencies between 150 and 800 kilocycles.

Dynamotor Unit PE-73-C furnishes the power required by the transmitter and operates from a 24/28 volt storage battery or other direct-current source used in aircraft.

II. INSTALLATION

GENERAL

Radio Transmitter BC-375-D and associated equipment are part of aircraft radio sets. Installation conditions vary widely and no detailed single set of installation instructions can be given in this book. However, separate instructions are furnished for each radio set and only such general instructions as should be followed in all installations are given in the following paragraphs.

The requirements for shielding and bonding of cords in aircraft installations are very rigid, in order that extraneous pick-up from the receiver side tone and radio frequency from the power supply will be minimized.

RADIO TRANSMITTER BC-375-D (Includes Mounting FT-151-A)

The transmitter outline dimensions and weights are shown on the attached drawings. See index for reference to the unit in question.

The transmitter should be located in relation to its associated equipment so that dynamotor and antenna leads will be of minimum length. Two types of shock-absorber mountings are available for use with the transmitter: Mounting FT-151-A is a tray-type and is part of the BC-375-D. Mounting FT-115-B is a disposable-type. The tray-type mounting, to which the transmitter is attached by four snap-slide catches, is normally used. The disposable mounting is sometimes added near the top of the transmitter to prevent swaying. Mounting FT-115-B consists of a rubber button in a steel shell which may be attached to the top, bottom, or sides of the transmitter. Certain of the transmitter-cover fastening screws have been placed so as to allow attachment of this mounting.

The transmitter should not be mounted closer than two inches from a wall, and in aircraft and vehicular installations it is desirable that Mounting FT-115-B be added at the top of the transmitter to prevent excessive swaying. The power cords should not be fastened nearer than 18 inches from the transmitter. This precaution prevents vibration from being transmitted to the unit through the cords. It is important that sufficient space be allowed in the front of the transmitter to facilitate replacement of tubes, removal of transmitter tuning units, and the making of tuning adjustments. After installation has been completed and tested, the snap-slide catches should be securely safety-wired at the places provided.

DYNAMOTOR UNIT PE-73-C

The dynamotor unit should be mounted in an accessible position to allow access to the relay-fuse box, keeping in mind that the length of the leads from the battery to the dynamotor unit must be as short as practicable. This unit when operated in conjunction with Radio Transmitter BC-375-D draws from 20 to 30 amperes. No 6 Awg or larger conductor should therfore be used for these leads in order to keep the voltage drop at a minimum. Mounting FT-107 should be securely attached so that the dynamotor unit cannot be torn loose by acceleration, vibration or shock.

After the dynamotor unit is clamped securely to Mounting FT-107 by means of the four snap-slide catches, Plugs PL-59 and PL-61 of the applicable cords should be plugged in Sockets SO-39 and SO-41, respectively on the dynamotor unit. The primary leads from the battery should then be clamped securely to the proper binding posts on the dynamotor unit terminal board.

CORDS

The cords to be used with the various radio sets are listed in the Parts Lists for same. The main transmitter schematic diagram shows the necessary cording for the Radio Transmitter BC-375-D. Plug PL-64 and Socket SO-44 contain the necessary intercon-

nections for the receiver and transmitter control.

ANTENNAS

Because of the wide variety of antennas in the radio sets of which Radio Transmitter BC-375-D is a part, no specific details will be given for antenna installations. However, the following general precautions should be observed:

1. The antenna and ground leads should be made as short as possible, except where the length of lead-in is definitely determined by the placement of radio set and antenna.

2. Antenna leads should be insulated to withstand radio-frequency potentials as high as 5000 volts.

3. Antenna leads should be so placed that operating personnel will not come in contact with them during normal operation of the equipment. Points accessible to personnel should be covered with Isolantite beads.

4. Ground connections should have as low resistance as possible. In aircraft installations the ground path should be well bonded. The "GND" post should always be connected to the ground system by a short lead, allowing, of course, for flexure due to vibration and shock. A link will be required between posts "LOAD A" and "LOAD B" when Antenna Tuning Unit BC-306-A is not used. This antenna tuning unit is not recommended when frequencies above 800 kilocycles are used.

5. Antenna leads between the antenna and transmitter and between the transmitter and the radio receiver should be located as far as possible from any primary wiring of the airplane. This applies especially to the wiring to the dynamotor unit and is necessary in order to decrease the pick-up of electrical interference by the antenna circuit wiring.

ANTENNA TUNING UNIT BC-306-A

This tuning unit is provided with Mounting FT-142. It should be mounted so that the tuning controls will be accessible during operation. It is desirable that the length of leads between the radio transmitter and the antenna tuning unit be kept to a minimum and that the leads be well insulated.

For operation on frequencies above 400 kilocycles, terminals "A—TRANS." and "B—ANT." on the antenna tuning unit are connected to "LOADING TERMINALS A" and "B" respectively on the radio transmitter. For operation on frequencies below 400 kilocycles, a jumper is placed across "LOADING TERMINALS A" and "B" on the transmitter. Terminal "A—TRANS." on the antenna tuning unit is then connected to the antenna post on the transmitter while the antenna connection is made to terminal "B —ANT." The post marked "GND" on the antenna tuning unit should always be connected to the transmitter ground.

REEL RL-30-B AND CONNECTOR CLAMP MC-163

The reel should be mounted in such a position that the crank is readily accessible and the counter is visible. In order to prevent excessive "piling" when the wire is being reeled in, the reel should be mounted at least six inches above the fairlead and so placed that the point at which the antenna wire leaves the spool is in line with the axis of the fairlead; that is, for best operation there should be no bends in the antenna wire between the point where it leaves the reel and the far end of the fairlead. The four mounting bolts can be inserted in the reel base through the hole provided in the web of the spool. Unless the mounting screws themselves are grounded, a heavy grounding wire or strap could be clamped under the nut of one of the mounting screws for the purpose of thoroughly grounding all metal parts of the reel.

To fasten the antenna wire to the bottom of the spool channel it is first necessary to remove the spool cover by withdrawing it forward over the spool. This can best be done by placing the fingers of both hands on opposite sides of the cover and pressing on the spool with the thumbs. The end of the wire should be looped under the anchor pin in the spool hub and then twisted around the wire proper a few times. The twisted loop should then be placed in the groove and all of the wire wound on the spool by turning the crank in a clockwise direction. At this point the cover should be replaced by passing the wire through the slot opposite the wire opening and pushing the cover over the spool until it rests against the flange on the back plate. The cover should now be rotated so that the wire from the fairlead to the spool will not rub the edges of the wire opening in the cover either when the spool is full or nearly empty. The counter should now be set to zero. This should be done each time the reel is used in order to reduce the error in the reading caused by irregularities in winding.

Electrical connection to the transmitter is made by means of Connector Clamp MC-163, the installation of which is as follows:

a. Remove the brass bushing from Connector Clamp MC-163 by loosening screw in top of cover and fasten the antenna lead from the radio transmitter to this bushing by means of the screw provided.

b. Replace the bushing in cover and place the connector over the top of the fairlead, clamping it into place by means of the screw in the side of the cover.

c. Wind the desired amount of Wire W-106 on the spool and feed the free end through the Connector Clamp and Fairlead until it touches the ground below the airplane

d. Connect the free end of the wire to the cable loop on the Weight WT-9. Considerable care should be taken in making the connection between the antenna wire and the weight cable in order that the joint will run smoothly through the connector clamp when the antenna is being let out or reeled in. The loop formed in the antenna wire should be as small as practicable and the section where the antenna wire is twisted back upon itself should be tapered and made as short as a safe joint will permit.

Wind up the antenna wire in the reel until the Weight WT-9 rests securely in the fairlead socket. Let out and reel in approximately ten feet of the antenna several times (have someone pull lightly on the weight to keep the antenna wire tight) to insure that the connector clamp is working properly and that the joint between the antenna wire and weight cable runs smoothly through the clamp.

Fairlead Extension F-9 is used when the standard Fairlead F-8 is not long enough. It consists of Coupling MC-161 and a 36-inch length of standard phenolic tubing of the same cross section as the tube of Fairlead F-8. The extension is installed by slipping Coupling MC-161 over the top of the fairlead tube so that it covers approximately 3 inches of the tube and then securing it in place by means of one of the clamps provided. The tubing may then be clamped into the coupling by means of the remaining clamp. This tubing may be cut to fit a particular installation, or more than one extension may be used if required.

INTERCONNECTION WITH THE RADIO RECEIVER IN AIRCRAFT

It is necessary, in order to minimize receiver noise, that the cord shields be well grounded and so supported that they cannot rub on other cords or metal surfaces. In order that the receiver used be coordinated with the transmitter, the receiver control wires should be connected to terminals 21 and 22 of Plug PL-64. These points are normally closed but are opened when the key is closed and the transmitter starts functioning.

III. PREPARATION FOR USE

GENERAL

After installation and before the equipment is put into operation, the circuits of all cords and external wiring should be checked to insure compliance with the circuit diagram and the applicable interconnection diagram. This circuit check should be made with all plugs removed from the sockets in the transmitter and power unit to determine that all cord and junction box connections are made as indicated on the diagrams. A voltmeter and battery may be used for this purpose. The plugs should be replaced in their respective sockets after this check.

RADIO TRANSMITTER BC-375-D

The following procedure is recommended for preparing the transmitter for use after installation:

1. Remove Plug PL-59 from the power unit or dynamotor unit and cover its socket with a Socket Cap M-164-A.

2. Remove the tube compartment shielding cover and insert the tubes. From the front of the transmitter, progressing from left to right, the tubes are as follows:

Tube VT-25—Speech Amplifier
Tube VT-4-C—Master Oscillator
Tube VT-4-C—Power Amplifier
Tube VT-4-C—Modulator
Tube VT-4-C—Modulator

3. *D-c Filament Supply:* (Note: This equipment is not designed for alternating-current operation.)

(a) Remove all links from the filament resistor connection board.

(b) Assuming that the primary source voltage is 28 (the terminal voltage of a 24-volt storage battery under charge), place the 24 V/28 V switch in the tube compartment in the 28-volt position.

(c) Set the transmitter signal switch on CW and the filament voltmeter switch on CW FIL.

(d) Place the OFF-ON switch in the ON position. This should start the dynamotor and apply filament supply potential to the transmitter, but not to the tubes. Connect link between adjacent studs on the 28 V and CW FILAMENT rows. The CW filaments will light and the filament voltmeter read. Repeat this until the two studs are found that when connected will cause the filament voltmeter to read 10 volts. Then place the OFF-ON switch in the OFF position and connect a link between the two studs just selected.

(e) Set the transmitter signal switch on VOICE and the filament voltmeter switch on MOD. FIL. Repeat the operation of (e) for the 28 V and MOD. FILAMENT rows of studs.

(f) Again place the OFF-ON switch in the ON position. Set the filament voltmeter switch on CW FIL. (signal switch on VOICE). The CW filament voltage will now be less than 10 volts. In the same manner, connect between the adjacent studs of the COMP. and CW FILAMENT rows until the filament voltmeter again reads slightly over 10 volts. The OFF-ON switch may then be

placed in the OFF position and this link fastened in the proper place.

(g) Cut off the charging generator, place the 24 V/28 V switch in the 24-volt position and in a similar manner to the preceding select the proper studs on the 24 V and CW FILAMENT rows and the 24 V and MOD. FILAMENT rows so that the filament voltmeter will indicate 10 volts in either position. As now adjusted the filament voltages will not require further adjustment unless the cable lengths or charging rates are changed. Ordinarily, in aircraft installations, a battery-charging generator is used at all times. The 24 V/28 V switch should accordingly be placed in the 28-volt position. If it is desired to check the operation of the radio equipment when the charging generator is below operating speed, this switch should be changed to the 24-volt position since operation at low voltage will reduce the life of the tubes.

4. Replace Plug PL-59 in the dynamotor or power unit.

NOTE: It will be noted that the filament voltmeter will show from 0.3 volt to 0.5 volt rise when the transmitter key is closed and plate current is being drawn.

This is a normal condition of the transmitter circuits and should be ignored, providing the above filament adjustment has been made correctly.

OPERATION AT HIGH ALTITUDE

Radio Transmitter BC-375-D and associated equipment may be expected to give satisfactory service on CW at all altitudes up to 27,000 feet. On TONE and VOICE, however, insulation breakdown may be experienced with Transmitter Tuning Unit TU-8-B (6200–7700 KC) above 25,000 feet and with Tuning Unit TU-9-B (7700–10,000 KC) above 19,000 feet. These altitude limitations may be exceeded slightly by care in tuning and by carefully guarding against accumulation of dust and other foreign matter in the equipment. Complete assurance of effective operation between 6200 and 10,000 kilocycles at altitudes between 19,000 and 27,000 feet may be had on CW alone. Transmitter Tuning Unit TU-22-B may be expected to give satisfactory service at all altitudes up to 15,000 feet.

DYNAMOTOR UNIT PE-73-C

Before being used for the first time, it is recommended that the end bells of the dynamotor be removed to make certain that the armature rotates freely in its bearings, and a check should be made to determine how much time has elapsed since the dynamotor unit was last serviced. If this time exceeds five months, follow lubrication instructions appearing in this book. Do not lubricate more often or add more lubricant than is specified in those instructions.

The voltage at the input terminals of the dynamotor unit must be 28 volts in order to obtain rated power output from the transmitting equipment.

IV. OPERATION

TRANSMITTER ADJUSTMENT

WARNING: Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Do not complete or maintain any connection between transmitter and dynamotor unit unless all duplicate unused sockets on the transmitter are covered by socket caps with catches properly snapped in place.

Assuming that the installation and preliminary adjustments have been made in accordance with sections II and III, the following operating procedure is recommended. Some of these adjustments need be made only at the time of installation.

Under no conditions should any of the switches on the transmitter or tuning unit be changed with the key or microphone button depressed. Insure that all switches position correctly; do not attempt to leave switches between points. Failure to observe this procedure causes undue arcing of the switch and severe strain on the vacuum tubes.

1. *CW Operation:* Select the transmitter tuning unit for the desired frequency. CW operation may then be obtained as follows:

(a) Place the signal switch on CW.

(b) From the calibration chart on the front of the transmitter tuning unit, set the band change switch A, the M.O. TUNING Control, and the P.A. TUNING Control for the desired frequency, and set the ANT. COUPLING SWITCH D on Point 1. (It should be remembered that the band change switch does not appear on Transmitter Tuning Units TU-7-B to TU-10-B inclusive.)

(c) Place the OFF-ON switch on the ON position. The dynamotor should now start and the m-o and p-a filaments will light. In case repeated failures of Fuse FU-22 are encountered and if such failures persist after compliance with instructions

pertaining to Dynamotor Unit PE-73-C, it is recommended that Fuse FU-22 be removed from the relay-fuse box and one extra Fuse Link M-168 inserted in the fuse cartridge. Fuse FU-22 will then have two fuse links in it and should be replaced in the relay-fuse box of the dynamotor unit. In no case should the use of more than two fuse links be attempted.

(d) Press the test key or the transmitting key. The vacuum tubes will now draw plate current as indicated by the TOTAL PLATE CURRENT METER. The p-a tuning should be checked immediately for resonance by varying the control slightly until a minimum total plate current is indicated. When the p-a circuit is properly resonated, the total plate current will be from 80 to 110 milliamperes.

(e) The antenna should next be tuned to resonance. Because a wide variety of antennas is possible, no specific instructions for antenna tuning are given other than instructions to effect antenna resonance by means of the controls provided on the transmitter, and on the antenna tuning unit whenever the latter is in use. The subject of ANTENNA ADJUSTMENTS is considered more in detail elsewhere in this instruction book, and should be referred to in preparation for operation of the equipment.

Antenna resonance is indicated by a reading of current on the ANT. CURRENT meter and by an increase in total plate current. The increase in plate current is the more sensitive indication of approaching antenna resonance. When the antenna is tuned to resonance. the total plate current reading will be somewhat higher than the off-resonance value. If the plate current is below 200 to 220 milliamperes, the coupling to the antenna should be increased by placing control D on a higher point and the antenna circuit retuned. When finally adjusted, the total plate current should read from 200 to 220 milliamperes. If necessary, detune the antenna circuit slightly, keeping the p-a dial "C" in resonance to keep within the plate current limits.

(f) The equipment is now delivering rated power output, and the transmission may be carried on by operating the transmitting key. In order to shut down the equipment, it is necessary only to place the OFF-ON switch in the OFF position.

2. *Voice Operation:* Assuming that the equipment has been placed in operation on CW, the following procedure is recommended for obtaining voice operation. Note the value of total plate current for CW operation. Then place the signal switch in the VOICE position and, by means of the MOD. BIAS adjustment in the tube compartment, adjust until the total plate current with the microphone switch depressed is approximately 20 to 35 milliamperes higher than for CW. The modulator tubes are now biased nearly to cutoff for proper Class B operation, and radiophone communication may be carried on by speaking into the microphone. It will be noted that the total plate current increases when the microphone is spoken into. This increase is due to current drawn by the modulator tubes. With sustained normal level of speech impressed on the microphone, the plate current should rise to an average of 300 milliamperes. If this value is not obtained, the INPUT LEVEL control in the tube compartment can be adjusted until the proper amount of modulation, as indicated by the correct plate current, is obtained.

Speech-amplifier Bias: The correct speech-amplifier bias will usually be found between 6.0 and 7.5 on the bias adjustment dial. Settings in this range will normally give the proper speech-amplifier plate current and optimum side-tone frequency on all tuning units.

3. *Tone Operation:* After the equipment has been adjusted for VOICE operation, it is necessary only to place the signal switch on TONE for proper tone telegraph operation. The total plate current on TONE will usually be between 300 and 350 milliamperes.

4. *Side Tone in Aircraft Set:* If the receiver circuits have been properly co-ordinated with the transmitter, the receiver control circuit will operate each time the transmitting key or microphone switch is closed, and the transmitter side tone will be supplied to the headset. When the key or the switch is opened, the receiver again becomes operative, thus allowing break-in operation. The SIDE-TONE level control located in the tube compartment, is used to adjust side tone to a suitable value for any particular installation. It will be noted that a higher level is desirable on voice position than on the CW and tone positions.

5. *Calibration Reset:* Due to necessary manufacturing tolerances, the inter-electrode capacity of a vacuum tube varies between limits fixed for each particular type of tube. Since the tube capacity is an appreciable part of any master-oscillator circuit, it is impossible to make up a calibration chart which will be exactly accurate for all tubes whose capacities are within the allowable limits. For this reason Radio Transmitter BC-375-D is provided with a calibration reset capacitor which enables the operator to reset the transmitter frequency to correspond with the calibration chart when the set is first placed in operation and thereafter whenever the master-oscillator tube is changed. A heterodyne frequency meter or other standard of frequency is required. The procedure is as follows:

(a) Allow transmitter to warm. The operator will obtain the most accurate results by allowing the transmitter to "warm up" on key locked "CW" for a period of at least 20 to 30 minutes before setting the calibration reset capacitor or checking the calibrated transmitter frequency.

(b) With the transmitter tuning unit for the highest working frequency placed in the transmitter, tune the transmitter for CW operation on one of the calibrated frequencies at the high frequency end of the band. (Approach the calibrated point by proceeding from a lower dial reading to a higher one.)

(c) Place the frequency meter in operation and adjust it to the frequency indicated on the transmitter calibration in accordance with the operating instructions and calibration chart furnished with the frequency meter. The calibration accuracy of this frequency meter should be 0.01 per cent, or better.

(d) Open the calibration reset port, located on the front panel, between the TEST KEY and TONE-CW-VOICE switch, insert a screwdriver, and rotate the calibration reset capacitor until the transmitter frequency coincides with that of the frequency meter or standard.

(e) Close the calibration reset port.

The transmitter calibration is now reset for any tuning unit of the same order number and serial number as the transmitter and the accuracy of calibration will be within 0.05 per cent plus the accuracy of the standard. The calibration must be checked in this manner each time the m-o tube is changed.

ANTENNA ADJUSTMENTS

The antenna is, in general, a system of conductors which, when excited by a radio-frequency voltage, sets up an electromagnetic and electrostatic field causing a component of this field to travel away from the antenna with the velocity of light.

The radiation characteristics of antennas, directivity, and radiation efficiencies are determined by their physical shape and location with respect to other bodies. In aircraft, since there is no wide latitude in physical design of fixed antennas, the problem becomes mainly one of determining the best methods of operating available designs.

It is necessary first to determine how the antenna impedances vary at the operating frequencies in order that the loading facilities may be properly used. The reactance of an antenna may be approximated from the theory of transmission lines in which uniformly distributed inductance and capacity are assumed, resistance and insulator leakage being neglected.

Selecting a certain length of antenna and plotting its reactance variation with frequency, we obtain repeating cotangent curves. It may be seen that at certain frequencies the reactance becomes zero. Under these conditions, the antenna is "resonant," analogous to a simple-series circuit tuned to resonance.

It may be noted that the "series" resonant points occur at all odd multiples of the first resonant frequency, which is called the fundamental frequency. The fundamental frequency, the third harmonic, and the fifth harmonic, all points of zero reactance, correspond to a voltage distribution along a simple vertical wire of "quarter-wave," "three-quarters wave," and "five-quarters wave." Antennas of this type, operated at zero or low reactances, are commonly called "current fed"; that is, they require low driving voltages for their operation.

At even multiples of the fundamental frequency, it may be seen that the antenna reactance is very high. Operation at the second and fourth harmonics corresponds to "half-wave" and "full-wave" operation. Under these conditions, antennas are "voltage fed"; that is, they require high driving voltages.

The resistance component of the antenna impedance is made of two parts: radiation resistance which represents the radiation of power or waves away from the antenna and which is productive of a useful result; and loss resistance which is a combination of losses due to conductor and ground resistance, and to dielectric hysteresis. Loss resistance performs no useful function and every effort should be made to maintain it very small in comparison with the radiation resistance. The efficiency of an antenna with respect to radiation of power may be expressed as the ratio of radiation resistance to total antenna resistance.

Antenna resistance varies over wide limits with frequency. The resistance values approach very high values at the even harmonics, and minimum values at odd harmonics. It is thus seen that the operation of a transmitter over a wide frequency band requires that the transmitter be capable of providing a considerable range of output voltages. This is accomplished in each transmitter tuning unit by a six-point ANT. COUPLING SWITCH, D. In order that the voltage range required be kept a minimum, antennas are usually "resonated"; that is, they are series tuned by either inductance or capacity as may be necessary so that the required output voltage range depends only on the antenna resistance variation over the desired frequency range. Transmitter Tuning Unit TU-22-B has a series capacitor in use when control D is on 6 for resonating when operating into a pure resistance approximating 40 ohms. Do not operate tap 6 into low resistances as the large

amount of resonant current will overload this series capacitor.

When operating antennas at frequencies lower than their fundamental or odd harmonics, they appear to the antenna tuning equipment as a capacity in series with a resistance. In order to balance out this capacitive reactance, it is necessary to load the antenna by means of an inductance, the reactance of which is made equal to that of the apparent antenna capacity. For operation of antennas at frequencies higher than their fundamental and odd harmonics, the converse is true, a capacity in series with the antenna being necessary in order to balance the apparent antenna inductive reactance.

In most cases, except where 3/4- and 5/4-wave trailing wires are used for high frequencies, antenna operation will be around the fundamental frequency.

In general, it may be said that if antennas are operated so that their effective length is an appreciable percentage of the operating wavelength, they will have marked directive properties. This corresponds to operation near to and higher than the fundamental frequency. When antennas are operated at frequencies much lower than the fundamental, the ratio of radiation to total resistance is less favorable, but the directive properties, are not nearly so evident. The fundamental frequency of an antenna depends mainly on its effective length including the ground lead. Fundamental frequencies in the range 2500–7000 kilocycles will be the most common with the usual types of fixed antennas, while fundamentals as low as 1500 kilocycles will be obtained with 200-foot trailing-wire antennas.

The antenna tuning equipment in the transmitter is designed to feed antennas at any frequency from 800 to 12,500 kilocycles. Over this band of frequencies it is necessary to feed antennas at, above and below their fundamental frequencies. Therefore, the circuit and circuit constants are so selected as to permit of both current and voltage feed. A rotating inductor and a tapped inductance provide the inductive reactance variation. A variable capacitor provides the variation in capacitive reactance and also serves as a coupling impedance for voltage feed. Controls governing the variation in inductive or capacitive reactance are so arranged that inductance or capacity are increased with increase in dial reading.

With the ANT. CIRCUIT SWITCH, N, on position 1, the transmitter works into a simple series resonant circuit, in which the high voltage built up across the antenna tuning capacitor is used to "Voltage feed" the antenna. This circuit is generally used for high frequencies and fairly long fixed antennas. The antenna feed circuit is maintained at resonance by means of ANT. IND. TUNING, M, while the voltage fed to the antenna is varied by means of ANT. CAP. TUNING, O, and ANT. COUPLING SWITCH, D. Feed circuit resonance is indicated by the ANT. CURRENT meter. The current in the feed circuit is adjusted by control D and should not exceed 6 amperes. The step-by-step tuning procedure is as follows:

1. Set control 0 at some arbitrary scale reading.

2. Resonate circuit by means of control M for a maximum reading on ANT. CURRENT meter.

3. Adjust control D so that antenna ammeter reads below 6 amperes.

4. Re-resonate circuit as in 2.

Repeat the above procedure until the proper loading (200–220 ma on CW) is indicated on the plate ammeter. The lower the dial reading on control M and the lower the reading on the ANT. CURRENT meter that it is possible to obtain at a given frequency, the more power will actually be delivered to a given antenna. The lower the reading on control M and the lower the ANT. CURRENT readings, the less the tuning circuit losses and thus more useful power is delivered to the antenna for radiation purposes.

With ANT. CIRCUIT SWITCH, N, on position 2, the transmitter works into a series resonant circuit where the antenna is "current fed." The antenna circuit is resonated by means of ANT. IND. TUNING, M, and ANT. CAP. TUNING, O, as indicated by the ANT. CURRENT meter. This circuit is used generally for operation near the fundamental frequency of the antenna.

With control N on position 3, the transmitter works into a series resonant circuit providing "current feed" and inductive loading. The antenna circuit is resonated by means of a continuously variable rotating inductor, control M. This circuit is used for operation below the fundamental frequency of the antenna.

With control N on position 4, the antenna circuit is identical with that obtained on position 3 except that an additional tapped inductance, controlled by ANT. IND. SWITCH, P, is added in series with the rotating inductor. This circuit is used when the operating frequency is relatively far below the fundamental frequency of the antenna.

It is recommended that the operator check the possible resonance of coil, item 1170, at operating frequencies above 4500 kilocycles. Although this coil is not connected in the antenna circuit, the inherent capacity coupling may cause absorption of useful radio-frequency power. Absorption may be easily determined by placing control switch "P" at several points while watching the antenna current. Control "P" must not be allowed to remain at a point which indicates a decrease in antenna current. In general, it will be found that no difficulty will occur if the following points are used.

Transmitting Tuning Unit	"P" Switch Position
TU-7-B	2
TU-8-B	5
TU-9-B	5
TU-10-B	5

The antenna resonance is then made in the usual manner using controls M, N, and possibly O.

For operation in the frequency range of 150 to 800 kilocycles, the externally connected Antenna Tuning Unit BC-306-A is used. This unit contains the necessary inductive reactance to resonate specified antennas at frequencies well below their fundamental. The variation in inductive reactance is provided by the ANTENNA VARIOMETER SWITCH, control E, and the ANTENNA VARIOMETER, control F. The proper connections are described in the section on INSTALLATION. In general, it will be necessary to use the Antenna Tuning Unit BC-306-A with Transmitter Tuning Unit TU-22-B. The antenna loading equipment contained in the transmitter will resonate a 400 micromicrofarad antenna to approximately 650 kilocycles. Therefore, when the minimum inductance is reached on the BC-306-A (E=2, F=O), place control E in position 1 which disconnects this unit. Proceed to resonate the antenna circuit with control N on 4. Control M is the continuously variable inductance between inductance steps on control P.

Under some conditions it may be found that one coupling tap will not give sufficient loading while the next higher tap will give overloading of the transmitter. In this case use the higher coupling tap by slightly detuning the antenna circuit and keeping the p-a dial C tuned to a minimum plate current until the normal transmitter loading of 210 to 220 milliamperes total plate current is obtained.

DYNAMOTOR UNIT PE-73-C

Starting and stopping of the dynamotor unit is controlled remotely by the "OFF-ON" switch at the Radio Transmitter BC-375-D. No adjustments are required or provided on the dynamotor unit.

When operated at full-rated load continuously for ½ hour the temperature rise of the dynamotor will not exceed 55 degrees Centigrade. However, if the dynamotor is operated for a greater length of time, even at lighter loads, without being allowed to cool off, its temperature will continue to increase and will ultimately reach values which are injurious to the insulation and may even burn out the windings. This also applies to the starting relay. If it is desired to operate the dynamotor unit continuously at full load for a period greater than ½ hour (such as for testing purposes in the laboratory), the end bells of the dynamotor and the cover of the relay-fuse box should first be removed. The dynamotor unit can then be operated at rated load continuously for any period of time without injurious heating. Care should be exercised to place guards around the dynamotor unit when operated in this manner so that the operators cannot come in contact with exposed high voltages. When operated in conjunction with the transmitter, the dynamotor operates at practically zero load unless the key or microphone switch is closed. Continuous operation under this condition will not result in overheating although the transmitter should be turned off whenever possible between the periods of transmission.

REEL RL-30-B

Braking, locking and winding operations are controlled from the crank on the reel. Normally the reel is in the locked position such that the wire will not unwind from the spool. Reeling-in is accomplished by rotating the crank in a clockwise direction, as indicated by the direction arrow "Wind" on the nameplate at the center of the reel spool. A ratchet mechanism on the spool prevents the wire from unreeling when the crank is released. By rotating the crank in a counterclockwise direction the braking mechanism is released, thereby permitting the wire to be reeled-out. Braking force decreases gradually as the handle is rotated through approximately the first 40 degrees of its motion. Beyond this point and up to the extreme limit of its motion the brake is completely released and the spool is free to spin. The speed of unwinding can be readily controlled by regulating the braking effect with the crank. A spring return on the crank automatically resets the brake to the normal or locked position when it is released.

Tuning the antenna by adjusting its length should be accomplished by allowing slightly more wire than is necessary to run from the reel and then reeling in slowly to obtain the proper length by observing the resonant condition. During the reeling-out operation, care should be taken that all of the wire is not unreeled. The speed with which the reeling takes place would be sufficient to snap the wire if it reached its ultimate length, causing a loss of both the weight and wire.

When unreeling wire, never allow the crank to snap into the locking position when the spool is rotating rapidly. The sudden stop which would result may break the antenna wire and place undue stress on the reel mechanism.

The following table gives the approximate antenna length for various frequencies as well as the approximate counter reading when 250 feet of Wire W-106 is wound on the spool.

Kc	1/4 Wave		3/4 Wave	
	Length (Ft)	Counter Reading	Length (Ft)	Counter Reading
2000	123	108		
3000	82	72		
4000	62	54		
5000	49	44	147	130
6000	41	36	123	108
7000	35	30	105	92
8000	31	28	93	82
9000	27	24	81	72
10000	24	22	73	64

OPERATING ROUTINE

The operating routine and type of transmission to be used will be governed by tactical requirements. The following recommendations are given, however, to assist in routine operation of the equipments:

1. Complete equipment operation should be checked before the start of any mission.

2. Make certain that spare fuseholders are filled with good fuses, and that spare tubes (if carried) are in good condition.

3. The transmission range of the equipment on CW is considerably greater than on VOICE. If distance, atmospheric noise, etc., make VOICE communication difficult, changing to TONE or CW will probably improve communication.

4. In case of failure of one or two VT-4-C vacuum tubes with no spares on hand, CW communication can be carried on by inserting the good tubes in the m-o and p-a sockets. CW operation can also be maintained when the Tube VT-25 is removed, although no side tone will be supplied in this event. Note that the radio-frequency and audio-frequency tubes are connected in series parallel. If one tube is removed, another filament will go out.

SUMMARY COVERING NORMAL OPERATION

Although the normal operation of this equipment is extremely simple after the correct installation has been made, it is well to study the proper sequence of various equipment procedures as summarized in the following paragraphs. It is assumed that the installation has been tested and all circuits are normal.

Do not change any switches with the key or microphone button depressed.

1. *To Start the Equipment:* Place the "OFF-ON" switch to "ON." The dynamotor will start and the filaments will light. Unless the "TONE" and "VOICE" emissions have been adjusted, start up initially on CW and adjust for the desired type of emission as given below. To control carrier depress the key.

2. *To Stop the Equipment:* Open the key then place the "OFF-ON" switch in "OFF."

3. *To Change Frequencies:* Select the required tuning unit and place in the transmitter. Place the m-o dial, band switch (if any)and the p-a dial on the desired calibrated frequency as given on the calibration chart. Place the emission switch on CW, start up the transmitter and immediately check the p-a dial for minimum plate current as indicated on the total plate current meter. Resonate the antenna circuit and load to a total plate current of 210 to 220 milliamperes with the p-a dial resonated, i.e., always tuned to a minimum plate current. Proceed to key the carrier on CW or select the other types of emission as given below.

4. *To Select Any Available Type of Emission:* Start up the transmitter and tune for CW transmission first as given under "3," then, open the key and place the TONE-CW-VOICE switch on VOICE. Remove the tube shield and adjust the "MOD. BIAS" after key is depressed until the total plate current reads 20 to 35 milliamperes above the CW value. Proceed to control carrier by microphone button and modulate by voice, adjust the side-tone signal to the desired level by means of the side-tone control located in the tube compartment. Adjust the voice level by the "Input Level" control so the total plate current reaches 300 to 350 milliamperes on peaks of sustained voice.

For Tone Transmission the operator must always adjust transmitter for VOICE, first. Then open the key, place the selector switch on TONE and proceed to key carrier as in CW.

5. *To Increase Power Output:* Go to a higher number on the antenna coupling switch "D" at the same time keeping the p-a dial "C" and the antenna circuit in resonance. Power may be increased until a CW plate current of 220 m.a. at 28 volts input is reached.

To Decrease Power Output: Go to a lower number on antenna coupling switch "D," at the same time keeping the p-a dial "C" and the antenna circuit in resonance.

It should be noted that the CW power output may be increased or decreased in the above manner from the value of plate current with the antenna circuit open to the full load rating of 220 milliamperes. However, the TONE and VOICE carrier powers SHOULD NOT BE INCREASED OR DECREASED. Unless the TONE and VOICE carriers are adjusted as given under Item "4" above, distortion will result. Also, the misadjustment may cause arc-overs which would damage the equipment.

6. *To Reset to the Calibration Chart,* after changing of the m-o tube, etc.: Start the transmitter on the highest frequency tuning unit available. Warm up the transmitter on CW key locked for 10 to 20 minutes. The tube shield must be in place. Listen to the calibrated frequency on a suitable accurate heterodyne frequency meter and adjust the transmitter to zero beat by means of a screw driver inserted into the reset port on the left front transmitter panel. This should bring the transmitter back to calibration and all other frequencies should be within 0.05 per cent. For greater accuracies reset as above to the exact frequency desired.

MAINTENANCE NOTES

Inspection

A thorough periodical inspection of the complete installation at least once every 50 hours of operation will materially aid in the maintenance of uninterrupted performance. The following inspection is recommended:

1. Determine that the storage battery is at the proper gravity and that the charging generator and regulator are adjusted so as to keep the battery fully charged.

2. Clean accumulated dust and dirt from all units. Use an air hose or bellows, paying particular attention to the loading coil, item 1170, in the antenna compartment of the radio transmitter. At this time inspect the rotating coil, in this compartment. The winding should be thoroughly cleaned with carbon tetrachloride (Carbona) and a clean cloth.

3. Make certain that all safety wiring is in place, that all mounting brackets and supports are rigidly fastened and that all nuts and machine screws are supplied with lockwashers and are tight.

4. Determine that no cords have broken shielding and that all grounding and bonding is in place.

5. Inspect plugs for proper fit and plug sockets for compressed pin springs. Compressed pin springs, which have taken a permanent set, can be restored by a light hammer blow on the end of the pin.

6. Make certain that all fuses are held tightly in their clips. A loosely held fuse should be removed and the clips bent with the fingers until they grip the fuse tightly. The clips and fuse ends should be kept clean and the contact surfaces bright.

7. Antennas should be inspected for broken or frayed leads, and insulators should be wiped clean. Be sure that antenna leads have not been bent close to metal frameworks where high antenna voltages might cause sparkovers.

8. Inspect keys and microphones for broken cords and deformed plugs.

9. Inspect dynamotor brushes for length and broken pigtail leads. Detailed instructions on care of brushes are given herein.

10. Inspect both dynamotor commutators for cleanliness and excessive wear. Information on care of commutators is given in these instructions.

11. Rotate the dynamotor armature by hand to make certain it turns freely and is not rubbing against the field poles or leads. When all four brushes are removed, the armature should spin freely on its bearings. Refer to detailed information on dynamotor bearings.

Lubrication

The lubrication of the equipment involves the use of three lubricants and one cleaning solvent. These are:

1. Light Oil: A high grade, low pour test, mineral oil with viscosity rating SAE10.

2. Light Oil: A high grade, low pour test, mineral oil with viscosity rating SAE20.

3. Grease: Use only high temperature ball bearing grease such as Grade 295 Air Corps Specification No. 3560. "Refined Calol Grease" as manufactured by the New Departure Manufacturing Company, Bristol, Connecticut, or New York and New Jersey Lubricant No. 1572 meet the requirements of the above specification. "Calol" is a stiff, pale yellow, high flow point, sodium base grease which has been developed particularly for ball bearing applications of this nature. Do not use unauthorized greases as these may melt out at high temperatures or may oxidize rapidly and become gummy when packed in the bearings.

4. Cleaning Solvent: Carbon tetrachloride (Carbona) is strongly recommended.

Periodic Lubrication Routine

Dynamotor Unit PE-73-C: Under normal operating conditions, the dynamotor bearings should be lubricated in accordance with the following schedule:

1. After every 1000 hours of operation or at intervals of six months, add 3 drops of SAE20 oil into the small oil hole which is provided in the top of each bearing housing and is closed by a screw plug.

2. After every 5000 hours of operation or at intervals of one year, add approximately 0.05 cu. in. ($\frac{3}{8}$-in. cube) of ball bearing grease to each bearing through the oil hole mentioned above.

NOTE: Do not add more oil or grease than specified above, since the excess lubricant will tend

to work out of the bearing housing onto the commutators and brushes where it will cause trouble if not wiped off. Too much grease in the bearing will have a tendency to churn and may cause the bearing to overheat. Always make certain that the lubricants used are clean and that no dirt, moisture or foreign matter enters the oil hole when adding the lubricant. Tighten screw plugs securely into the oil holes as soon as lubricant is added.

3. After every 10,000 hours of operation or at least every two years, remove the armature from the dynamotor, thoroughly clean the bearings and bearing housings with carbon tetrachloride and repack each ball bearing level full of approved ball bearing grease. See procedure for disassembly and cleaning of bearings.

Reel RL-30-B: The construction of this unit is such that it will require very little attention. The following lubrication routine is recommended to obtain the best operating results:

1. After every 20 hours of flying service apply six drops of SAE10 oil at the oil hole indicated on the hub nameplate.

2. After every 1000 hours of flying time or every six months, whichever comes first, do as follows:

(a) Remove the three fillister head screws which hold the crank handle lever to the hub and remove the crank.

(b) Remove the small cotter pin and castle nut on the end of the reel shaft.

(c) Remove reel spool and hub from the shaft.

(d) Clean the accumulated dirt from reel shaft and the parts in the mounting base. Examine the exterior parts of the reel hub and clean off all dirt.

(e) Lubricate these points using SAE10 oil:

Counter gear shaft bearing—1 drop.

Main shaft—several drops along the bearing surfaces.

Rear ball bearing on hub adjacent to ratchet teeth—5 drops.

Front thrust bearing around the edge of the retaining nut at the front end of the hub—5 drops.

Front ball bearing around the gap between the outside of the hub and the edge of the piece into which the three screws from the crank handle lever are threaded—5 drops.

(f) Reassemble the reel as follows: Place the reel spool and hub on the shaft. Give the spool a slight spin clockwise until the ratchet engages the pawls.

Replace the castle nut with the fingers, run it down until snug and then back it off until the hub runs free (at least $\frac{1}{6}$ of a turn). Replace the cotter pin. Assemble the crank handle and tighten the three fillister head screws.

This completes the operation of servicing the reel.

Miscellaneous Lubrication

The following miscellaneous lubrication instructions should be followed in connection with the maintenance of Radio Transmitter BC-375-D. Places to oil and grease are listed. Do this after every 500 hours of service or at least after every 1000 hours. Do it oftener if dirt accumulation is excessive. Clean parts as required.

Oil SAE 20 —Switch shafts in transmitter, transmitter tuning units, and antenna tuning unit. Vernier mechanisms in transmitter, transmitter tuning unit, and antenna tuning unit. Variable capacitor shafts in transmitter and transmitter tuning units.

Grease—Contacts of switches, and switch positioning devices in transmitter, transmitter tuning unit and antenna tuning unit.

NEVER lubricate the contact roller or the contact roller shaft of the rotating antenna inductor. These parts should run DRY and should always be kept spotlessly clean. Carbon tetrachloride (Carbona) should be used to clean these parts.

SERVICE NOTES

In the servicing and locating of faults in the transmitter and associated equipment, it is necessary to remove various shields and covers to make the circuits accessible. Great care must be taken in testing with shields removed, because a great many points of high voltage are thus exposed. Whenever such testing is necessary, the proper procedure is to remove all power from the equipment, make the necessary circuit changes or meter connections and then apply power, keeping clear of all meters which are connected in the "high" sides of circuits where there may exist an appreciable voltage to ground.

Always remember that when the dynamotor is running and the transmitting key is open, high voltage is present in the transmitter even though there is no plate ammeter reading.

In checking low voltage and filament circuits, the single conductor cord with the Plug PL-59 should be disconnected from the transmitter, thus removing the high-voltage supply. It will be noted from observation of the schematic diagram that two tube filaments are connected in series. Thus, if one fails, two filaments will go out. The defective tube can be determined by use of a continuity meter.

The following information is supplied to aid in servicing the equipment:

1. *Voltage Readings*

(A high-resistance voltmeter should be used—at least 1000 ohms per volt.)

(a) Low-voltage input of 24 to 28 volts, depending on the power-supply voltage, should be obtained from terminal 45 of Socket SO-41 to ground.

(b) Speech-amplifier plate voltage of approximately 425 volts should be obtained at the plate connection of the speech-amplifier tube when the transmitter is on VOICE. It is recommended that a tube socket adapter be used which will allow not only readings of voltages but also all currents for the Tube VT-25.

(c) Modulator bias voltage of 72 to 75 should be obtained across capacitor 1160, the positive side being at ground potential. Selector switch should be on VOICE.

(d) Speech-amplifier bias voltage of 35 to 40 should be obtained across capacitor 1144, the positive side being at ground potential. Transmitter switch should be on VOICE.

(e) Plate voltage of 1000 to 1100 volts should be obtained between terminal 61 of Socket SO-39 and ground.

(f) Keying voltage of approximately 200 volts will be obtained across resistor 1115 when keying relay 1189 is open.

(g) Microphone-supply voltage of 4.5 to 5.3 volts d-c should be obtained across resistor 1145.

For this test, the microphone should be in the circuit.

2. *Current Readings*

(a) Speech-amplifier plate current should be from 19 to 21 milliamperes. Adjustment of its bias voltage to obtain this value is accomplished by potentiometer 1114 which is accessible in the tube compartment. The normal setting of this potentiometer will usually be between dial positions 6 and 7.5.

(b) Modulator plate current may be determined by observing the increase in total plate current reading when changing from CW to VOICE and impressing normal modulation. The modulator plate current should average 100 to 160 milliamperes for sustained tones. A greater or smaller value than this indicates that a readjustment of the input level should be made.

(c) Master-oscillator plate current can be determined on the total-plate-current meter by removing the p-a and speech-amplifier tubes and placing the transmitter on CW. The current indicated should be from 30 to 75 milliamperes, depending on the transmitter tuning unit in use.

(d) Power-amplifier plate current may be determined by subtracting from the total plate current on CW the currents drawn by the master oscillator and speech amplifier. Its value should be from 100 to 150 milliamperes at full load.

(e) Master-oscillator grid current can be determined by connecting a d-c milliammeter in series with resistor 1109. Correct value should be from 30 to 50 milliamperes.

(f) Power-amplifier grid current can be determined by inserting a d-c milliammeter in series with resistor 1112. Correct value is from 15 to 25 milliamperes.

Various other circuits may be checked by referring to the schematic diagram. Then by referring to the various unit connection diagrams, the location of the various circuit elements may be ascertained.

3. *Neutralization of Power Amplifier*

Neutralization of the power amplifier is not ordinarily necessary, since this is done when the units are tested at the manufacturer's plant. However, if the setting is disturbed for any reason, the following procedure may be used to restore the adjustment.

The transmitter should first be set up and tuned to see that all power supplies are correct and the transmitter is functioning properly. Then remove the power supply cords and the back of the transmitter. From Connection Diagram W-7350805 locate wire 43 (red) on filter capacitor 1163. Remove this wire with a soldering iron and tape clear of terminal on capacitor 1197A. This removes the power-amplifier d-c plate voltage and leaves the r-f circuits intact. Connect the vertical plates of a cathode-ray oscillograph to terminals "LOAD A" and "GND." on the radio transmitter. Place the "ANT. IND. TUNING, M" at dial zero and the "ANT. CIRCUIT SWITCH, N" on position "3." Tune the p.a. to resonance as shown by a maximum amplitude of r-f carrier on the oscillograph. Proceed by turning the neutralizing control, behind the tuning chart, for a minimum amplitude on the oscillograph, at the same time maintaining the p.a. in tune. When the best minimum is reached, with the p.a. in tune, the tuning unit is neutralized. In the lower frequency tuning units, the oscillograph pickup will be practically zero at neutralization, while on the higher frequencies, considerable amplitude will be noticed from stray ground currents. A check on the neutralization may be made by noticing the low reaction on the total plate meter, at neutralization, as the p.a. is tuned through resonance. The operator must remove

all power plugs, while the transmitter back cover is removed and lead (43) is resoldered.

4. *Dynamotor Unit PE-73-C*

(a) BRUSHES: The brushes can be removed by unscrewing the slotted brush cap on each side of the bearing bracket. It is recommended that each brush be suitably marked to indicate which brush holder it came from and its relative position in that brush holder in order that the brushes may later be replaced in their original positions. THIS IN IMPORTANT. Blow out dust and clean all foreign matter from each brush holder and brush and make certain that the brushes slide freely in their brush holders, dressing the brushes with fine sandpaper, or a file, if necessary. Any brushes which have worn down to a length of less than $\frac{3}{8}$ in. (measured from contact surface to near end of spring) should be replaced with new one. In installing new brushes it may be necessary to "sand-in" the brush in order to make its contact surface fit the contour of the commutator. The brush must slide freely in its holder.

"Sanding-in" may be accomplished by using a strip of No. 00 sandpaper about 5 in. by 1 in. for L.V. brushes and 8 in. by $\frac{5}{8}$ in. for H.V. brushes. Wrap the strip of sandpaper around the commutator with the sand surface out. Insert the brushes in the brush holders and replace the brush caps so that the brushes are pressed tightly against the sandpaper. Holding the ends of the sandpaper so as to stretch it tightly against the commutator, rotate the armature back and forth until the full width of the brush face is making contact against the sandpaper as indicated by the sanding marks or scratches on the contact surface of the brush when it is withdrawn. Sand the sides of the brush, if necessary, for a free fit in the holder.

No sanding should be necessary to secure a good brush fit with the original brushes if they are replaced correctly. Never apply oil, grease or any other lubricant to the brush, commutator or brush holder. Under normal conditions of operation, it is estimated that the useful life of brushes is 2000 hours for low-voltage and 10,000 hours for high-voltage brushes.

(b) COMMUTATORS: Both commutators should be wiped with a clean, lintless cloth. Any scum appearing on the low-voltage commutator should be removed by moistening the cloth in carbon tetrachloride (Carbona). The normal black or dark brown polished surface on the high-voltage commutator should not be removed. The type of brush material used in the low-voltage brushes of the dynamotor may, under certain conditions of installation, cause a discoloration of the low-voltage commutator. Under these circumstances the commutator will have a mottled appearance which is caused by the formation of a very thin oxide film on the surface of the commutator bars. This film is normal and is not injurious to the commutator or brushes. Do not try to remove the oxide film described above. A rough or pitted commutator should be smoothed with No. 00 or finer sandpaper. **Never use emery cloth or a file.** Under normal conditions of operation the low-voltage and high-voltage commutators should not require turning down before 2000 hours and 10,000 hours of service, respectively. However, if the commutator bars have worn down flush with the mica, the armature should be removed from the dynamotor to turn down the commutator face and undercut the mica between bars.

(c) BEARINGS: If the armature does not spin freely when rotated by hand with the brushes removed the following may be the cause:

1—Dirt or other foreign matter in a bearing.

2—Defective ball bearing (cracked race, chipped or flattened ball).

3—Grease in bearing has become hard and gummy due to oxidation during long periods without actual use.

In any case, the armature should be removed from the frame as described under "Disassembly" and the bearings thoroughly cleaned. If, after cleaning, the outer race will not spin smoothly, it is probably due to a cracked race or chipped or flattened ball, and the defective bearing should be removed and replaced with a new one. Always use a bearing puller to remove a defective bearing and never hammer or pry the bearing off since this may bend the shaft and injure the commutator. A new bearing should be pressed on the shaft until the inner race of the bearing rests against the shoulder on the shaft. For this operation always use an arbor press and a metal cylinder or collar which bears only against the inner race of the bearing. Care must be taken that no force or stress is placed on the outer race of either bearing at any time since this will usually result in a damaged bearing.

(d) DISASSEMBLY: The following procedure is recommended for disassembling the dynamotor for cleaning and repacking the bearings:

1—Remove the three "safety-wired" screws on each end of the dynamotor and take off the two end bells.

2—Unscrew the slotted brush cap in each brush holder and remove all four brushes. Take special care to mark the position of the brushes in their brush holders such that they may later be replaced in their exact original positions.

3—Unscrew the four slotted screws located around the rim of the low-voltage bearing bracket and pry the bracket loose from the frame. The low-voltage end of the dynamotor can be identified by the long, small diameter commutator and the large copper-graphite brushes.

4—Detach the two field leads from the terminal clamps on the low-voltage brush holders by unscrewing the screw in each terminal clamp. It is not necessary nor advisable to remove the terminal clamp from the brush holders.

5—The bearing bracket can now be taken out of the way and the armature withdrawn from the frame. Take care not to injure the armature windings or commutator by rubbing against the field poles. Do not lose any shim washers which may be in the bearing housings, or which may stick to the bearing. If any shims are present they must be reassembled in the same housing.

6—End Play Adjustment: A spanner screw is provided on one bearing bracket for adjusting end play in the dynamotor. This is properly adjusted at the factory and ordinarily will not need to be changed unless the armature is replaced. Before making any adjustments with this screw, it is necessary that two setscrews on either side of the bearing be loosened.

The proper adjustment is made by operating the dynamotor until it is hot (about 30 min.), then screwing the spanner screw in until the bearings begin to growl, then back off about ⅛ turn (45 degrees). The setscrews should then be tightened to hold the spanner nut in position.

7—In cleaning the ball bearings it is not necessary to remove them from the armature shaft. Simply immerse the bearing in a shallow pan of clean carbon tetrachloride and wash all of the grease from the bearing. The use of a small camel's-hair brush will greatly aid the thorough cleaning of the bearing. Change the cleaning solvent in the pan as soon as it becomes dirty. Always use clean solvent for the final rinsing of the bearings.

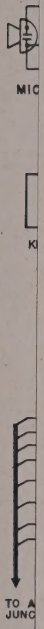
Do not allow the cleaning solvent to come in contact with the commutators or windings. In case the cleaning fluid is accidentally splashed on these parts, wipe it off immediately. Make certain the bearing is thoroughly clean and dry before repacking with new grease. If the bearing is not to be repacked with grease within a few minutes after cleaning, flush it with a clean, light mineral oil to protect the polished balls and races from rusting.

8—In reassembling the dynamotor, follow in reverse order the procedure for disassembly. Make certain that the two field leads are securely attached to the proper terminal clamps on the low-voltage brush holders and that the "slack" or "loop" in these leads is "tucked" back of the field coils. Do not loosen or remove the brush holders from the bearing brackets. If a brush holder is loosened or removed for any reason, replace it securely in exactly its original position and check to make certain the contact surface of the brush fits the commutator perfectly. If necessary, sand-in the brush to secure a good fit against the commutator.

(e) TYPICAL PERFORMANCE: The dynamotor unit alone without the transmitter should operate approximately as follows on a load test:

Input		Output	
Volts	Amperes	Volts	Milliamperes
24.0	5–7.5	1140–1160	0
24.0	14–16.5	1070–1090	220
24.0	20–22.5	1025–1050	350

Note: The input current above includes that taken by the starting relay.


MIC
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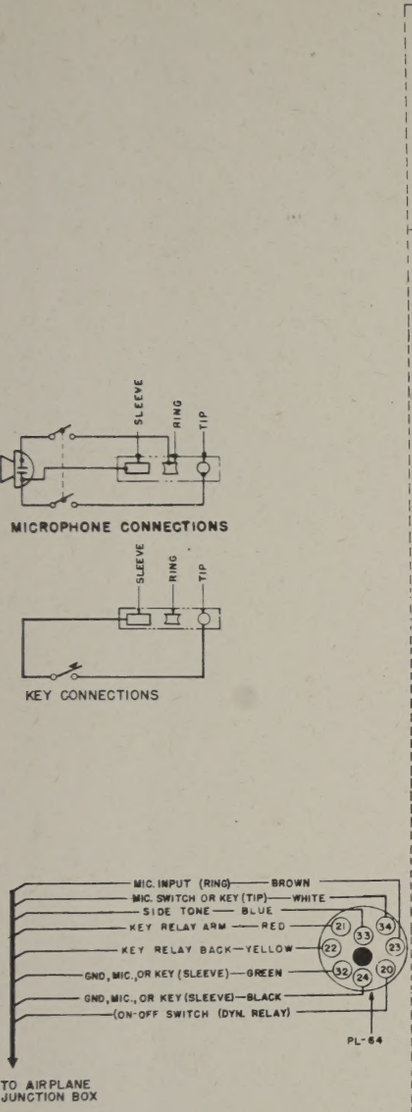
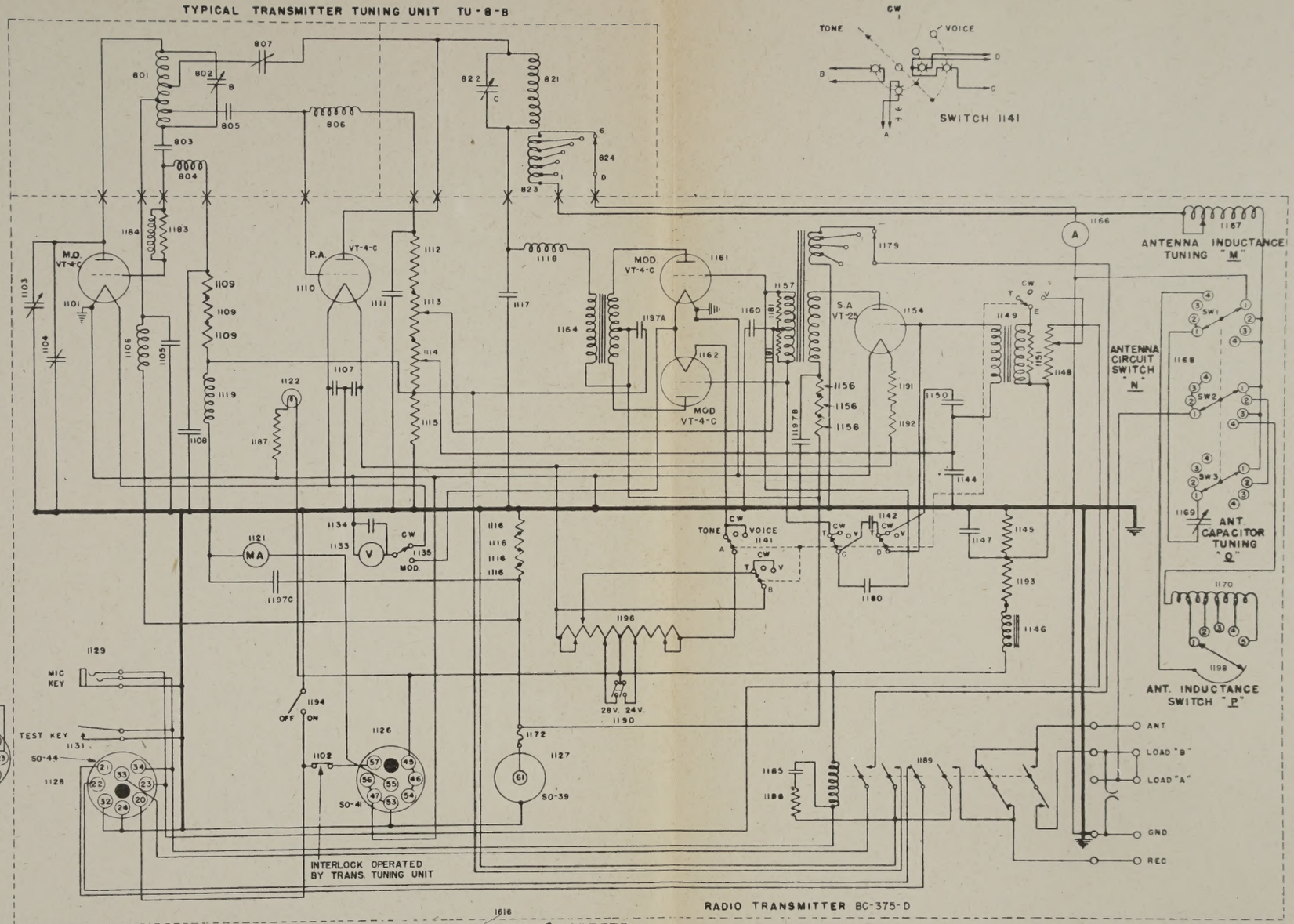
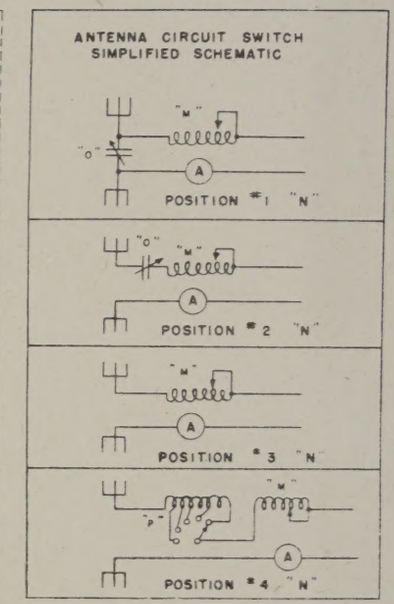
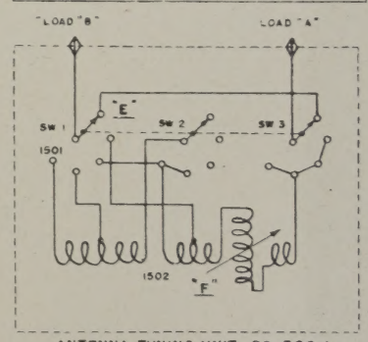
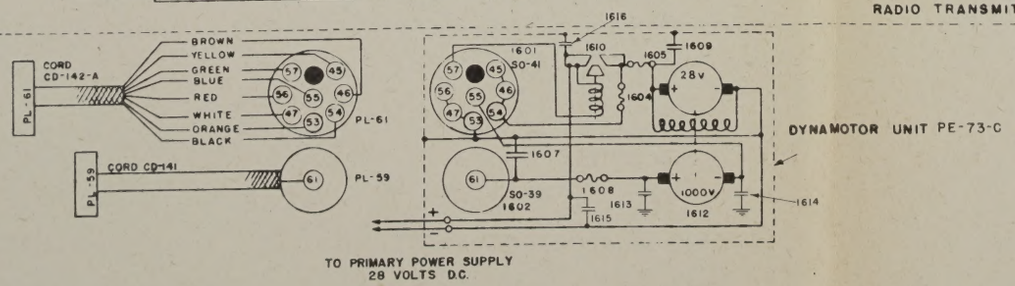

MIC. INPUT (RING) — BROWN
MIC. SWITCH OR KEY (TIP) — WHITE
SIDE TONE — BLUE
KEY RELAY ARM — RED
KEY RELAY BACK — YELLOW
GND., MIC., OR KEY (SLEEVE) — GREEN
GND., MIC., OR KEY (SLEEVE) — BLACK
(ON-OFF SWITCH (DYN. RELAY)
PL-64
TO AIRPLANE JUNCTION BOX









T-7661273 -- Radio Transmitter BC-375-D, Schematic Diagram

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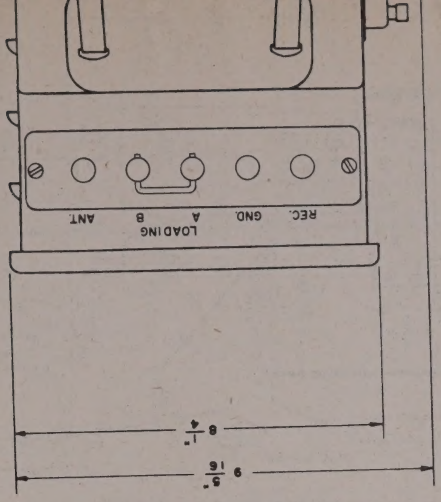

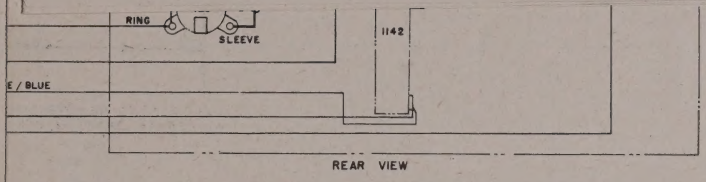

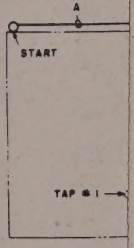

NOTE:-

W-7350805 -- Radio Transmitter BC-375-D, Connection Diagram

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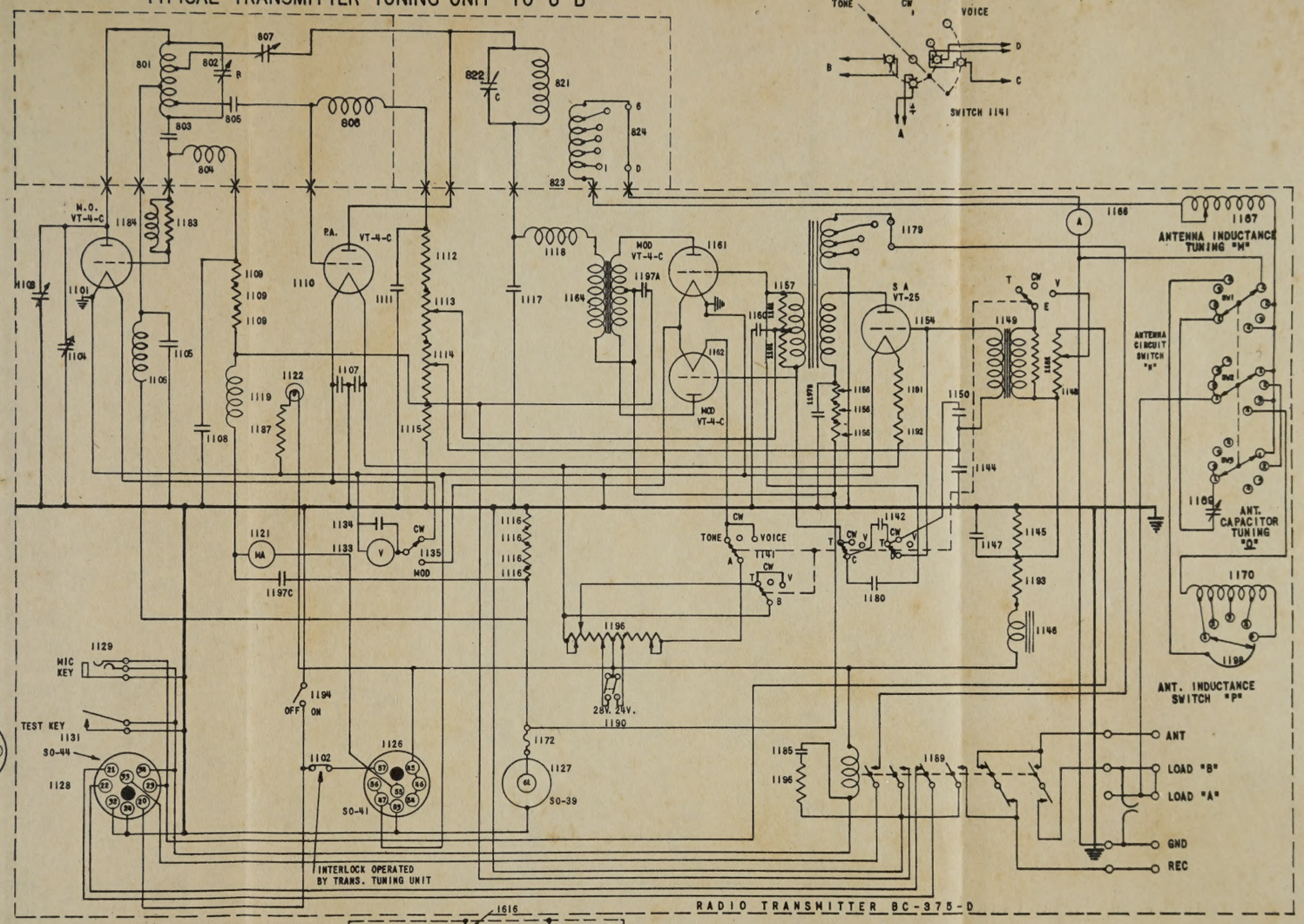
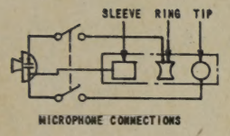
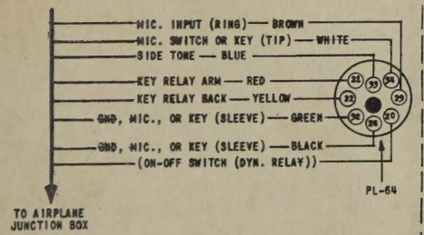
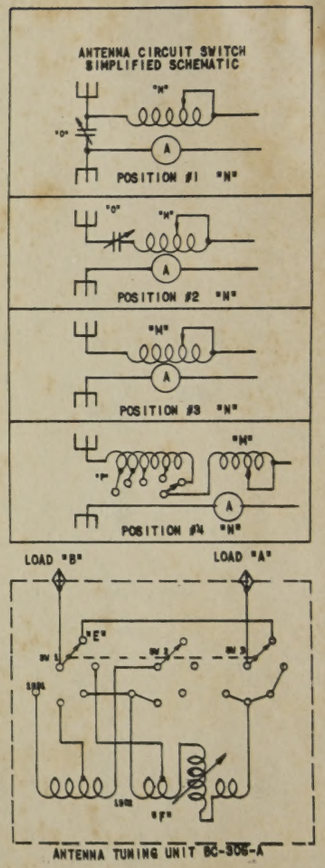
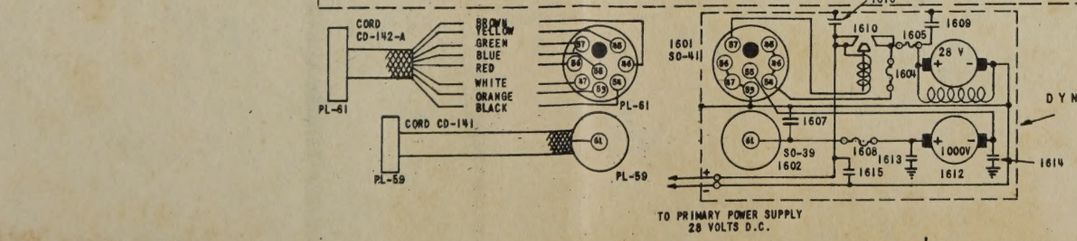
TYPICAL TRANSMITTER TUNING UNIT TU-8-B






MIC. INPUT (RING) — BROWN
MIC. SWITCH OR KEY (TIP) — WHITE
SIDE TONE — BLUE
KEY RELAY ARM — RED
KEY RELAY BACK — YELLOW
GND, MIC., OR KEY (SLEEVE) — GREEN
GND, MIC., OR KEY (SLEEVE) — BLACK
(ON-OFF SWITCH (DYN. RELAY))
PL-54
TO AIRPLANE JUNCTION BOX



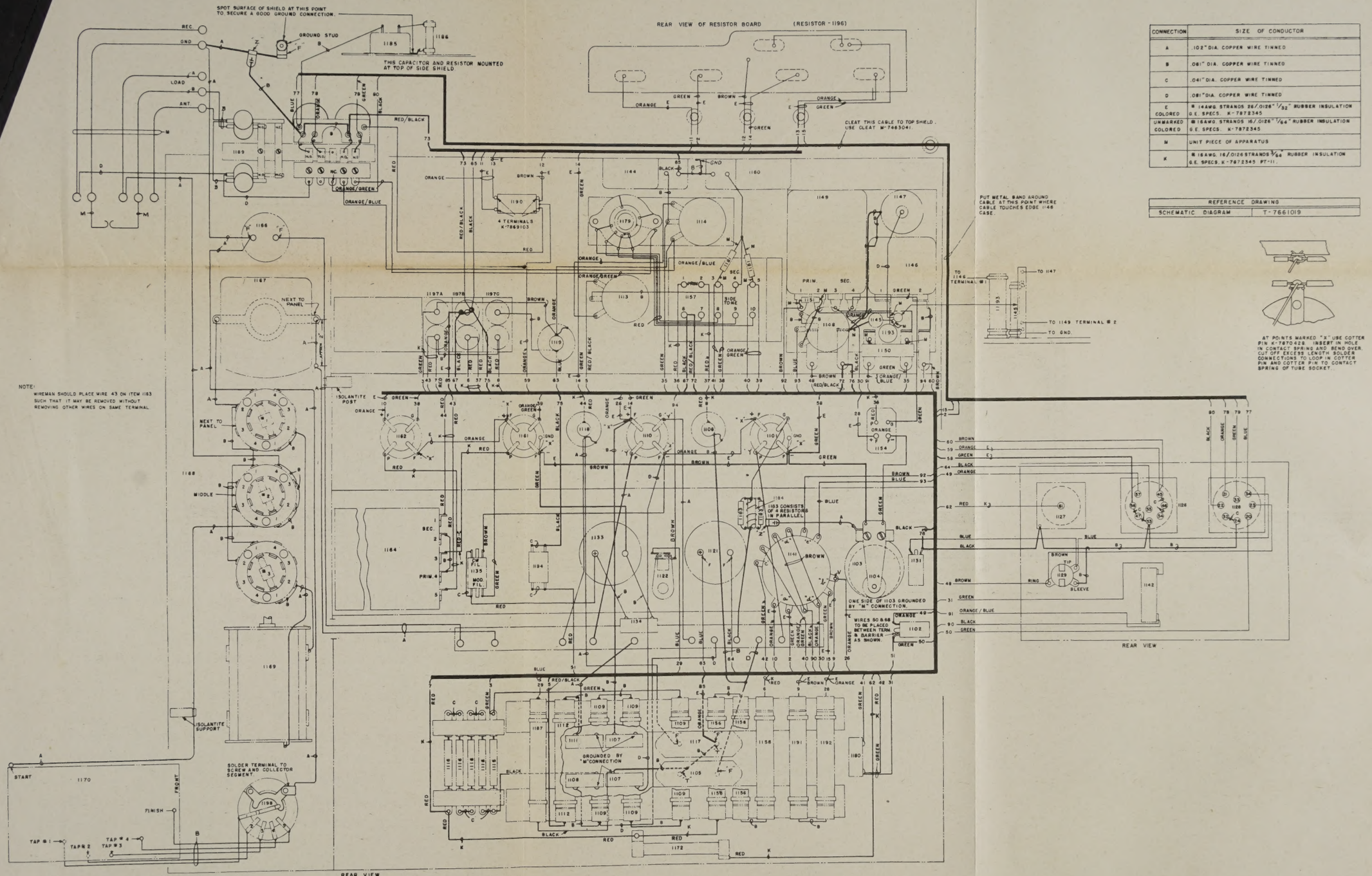


RESTRICTED

-1-

RADIO TRANSMITTER BC-375-D
SCHEMATIC DIAGRAM

TL.1059 (12-1-44)


SPOT SURFACE OF SHIELD AT THIS POINT TO SECURE A GOOD GROUND CONNECTION.
GROUND STUD
THIS CAPACITOR AND RESISTOR MOUNTED AT TOP OF SIDE SHIELD.
REAR VIEW OF RESISTOR BOARD (RESISTOR - 1196)
CLEAT THIS CABLE TO TOP SHIELD. USE CLEAT W-746304.
PUT METAL BAND AROUND CABLE AT THIS POINT WHERE CABLE TOUCHES EDGE 1148 CASE.
TO 1147
TO 1146 TERMINAL #1
TO 1149 TERMINAL # 2
TO GND.
4 TERMINALS K-7869103
NEXT TO PANEL
SOLANTITE POST
NEXT TO PANEL
MIDDLE
SOLANTITE SUPPORT
SOLDER TERMINAL TO SCREW AND COLLECTOR SEGMENT
START
FINISH
TAP # 1
TAP # 2
TAP # 3
TAP # 4
FRONT
1103 CONSISTS OF 4 RESISTORS IN PARALLEL.
ONE SIDE OF 1103 GROUNDED BY "M" CONNECTION.
WIRES 50 & 68 TO BE PLACED BETWEEN TERM & BARRIER AS SHOWN
GROUNDED BY "M" CONNECTION
REAR VIEW
REAR VIEW

CONNECTION	SIZE OF CONDUCTOR
A	.102" DIA. COPPER WIRE TINNED
B	.081" DIA. COPPER WIRE TINNED
C	.041" DIA. COPPER WIRE TINNED
D	.081" DIA. COPPER WIRE TINNED
E COLORED	# 14AWG. STRANDS 26/.0126" 1/32" RUBBER INSULATION G.E. SPECS. K-7872345
UNMARKED COLORED	#16AWG. STRANDS 16/.0126" 1/64" RUBBER INSULATION G.E. SPECS. K-7872345
M	UNIT PIECE OF APPARATUS
K	# 16AWG. 16/.0126 STRANDS 3/64 RUBBER INSULATION G.E. SPECS. K-7872345 PT-11.

REFERENCE DRAWING	
SCHEMATIC DIAGRAM	T-7661019

AT POINTS MARKED "X" USE COTTER PIN K-7870422. INSERT IN HOLE IN CONTACT SPRING AND BEND OVER. CUT OFF EXCESS LENGTH SOLDER CONNECTIONS TO LOOP IN COTTER PIN AND COTTER PIN TO CONTACT SPRING OF TUBE SOCKET.

NOTE: WIREMAN SHOULD PLACE WIRE 43 ON ITEM 1163 SUCH THAT IT MAY BE REMOVED WITHOUT REMOVING OTHER WIRES ON SAME TERMINAL.

NOTE: FASTEN WIRES SECURELY TO TERMINALS MECHANICALLY BEFORE SOLDERING. USE ROSIN CORE SOLDER #2003C. APPLY ONE COAT OF # 1234 GLYPTAL OVER ALL SOLDERED JOINTS.

THE HEAVY LINES, HIGHWAYS, ARE MERELY GUIDE LINES TO ASSIST IN TRACING CONNECTIONS ON THE DIAGRAM AND DO NOT NECESSARILY INDICATE CABLES. CONDUCTORS SHOULD BE CABLED IN THE MOST CONVENIENT MANNER WHEREVER CABLING IS ADVANTAGEOUS.

HEAVY LINE FOR CONDUCTOR INDICATES GROUND CIRCUIT.

AT POINTS MARKED "X" (TUBE SOCKETS) USE COTTER PIN K-7870422.

AT POINTS MARKED "T" USE TERMINAL K-7872504.

AT POINTS MARKED "F" USE TERMINAL K-7870226.

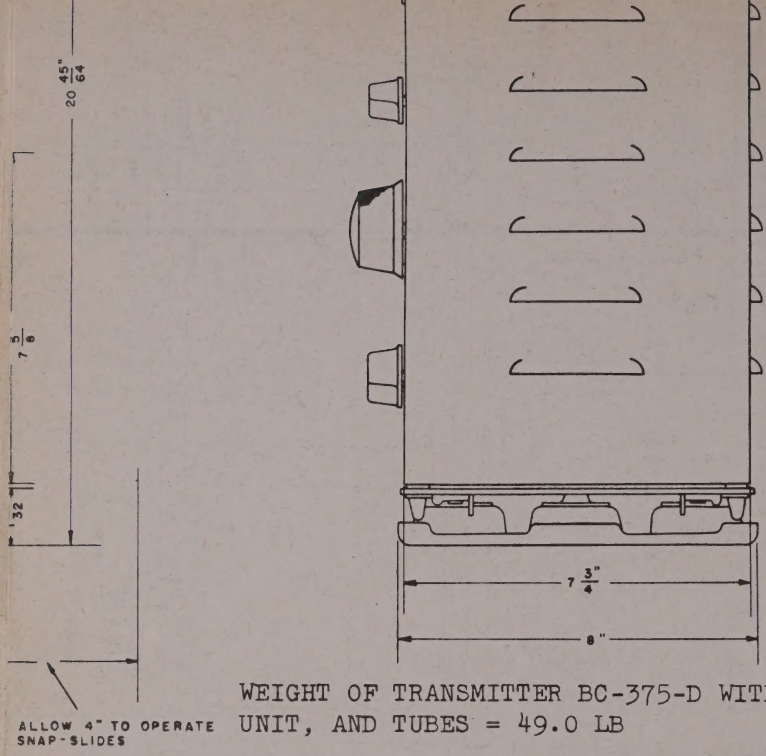
AT POINTS MARKED "Z" USE TERMINAL K-7872560.

AT POINTS MARKED "W" USE $\frac{1}{16} \times \frac{3}{8}$ COTTER PIN.

AT POINTS MARKED "W" USE CONNECTOR K-7872680.

AT POINTS MARKED "T" USE HAT TIN DIPPED WASHER V-417453

W-7350805 -- Radio Transmitter BC-375-D, Connection Diagram



WEIGHT OF TRANSMITTER BC-375-D WITHOUT MOUNTING, TUNING UNIT, AND TUBES = 49.0 LB

WEIGHT OF MOUNTING FT-151-A = 3.75 LB

WEIGHT OF 1 SET OF TUBES CONSISTING OF 4 VT-4-C AND 1 VT-25 = 2 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-5-B = 14.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-6-B = 12.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-7-B = 11.687 LB

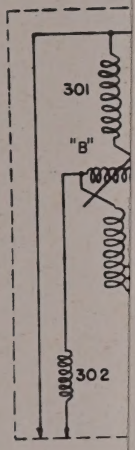
WEIGHT OF TRANSMITTER TUNING UNIT TU-8-B = 11.437 LB

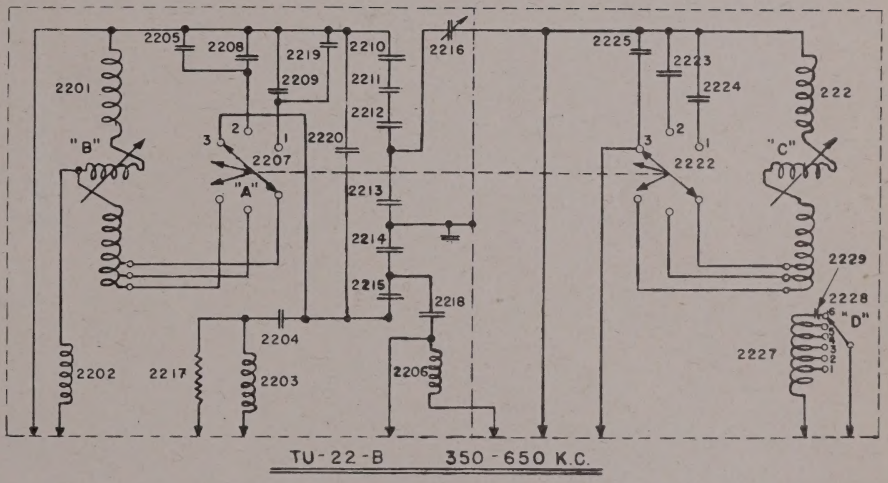
WEIGHT OF TRANSMITTER TUNING UNIT TU-9-B = 11.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-10-B = 11.437 LB

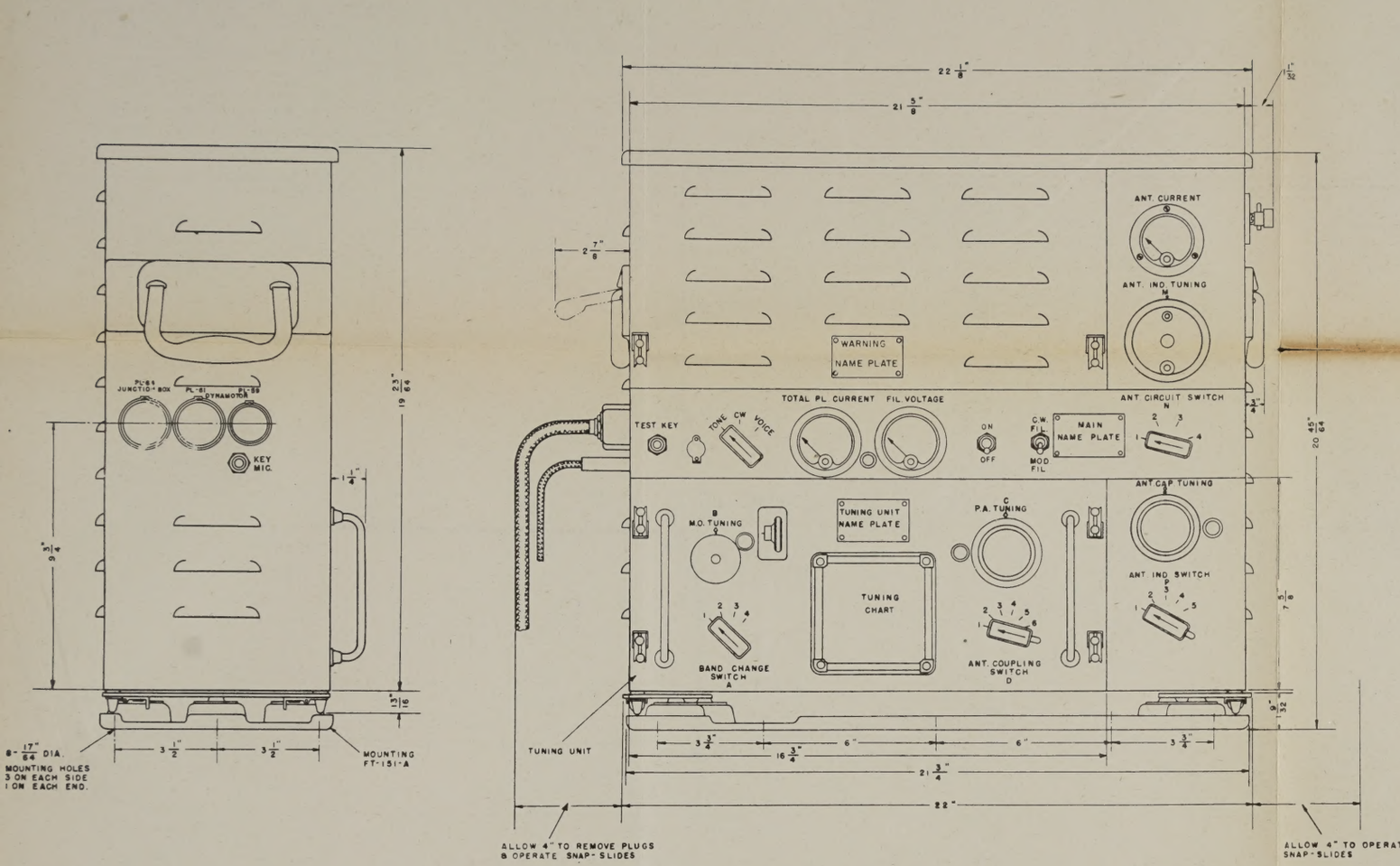
WEIGHT OF TRANSMITTER TUNING UNIT TU-22-B = 12.250 LB

T-7661418 -- Radio Transmitter BC-375-D, Dimensions and Weights





T-7661308 -- Transmitter Tuning Units, Schematic Diagram



WEIGHT OF TRANSMITTER BC-375-D WITHOUT MOUNTING, TUNING UNIT, AND TUBES = 49.0 LB

WEIGHT OF MOUNTING FT-151-A = 3.75 LB

WEIGHT OF 1 SET OF TUBES CONSISTING OF 4 VT-4-C AND 1 VT-25 = 2 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-5-B = 14.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-6-B = 12.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-7-B = 11.687 LB

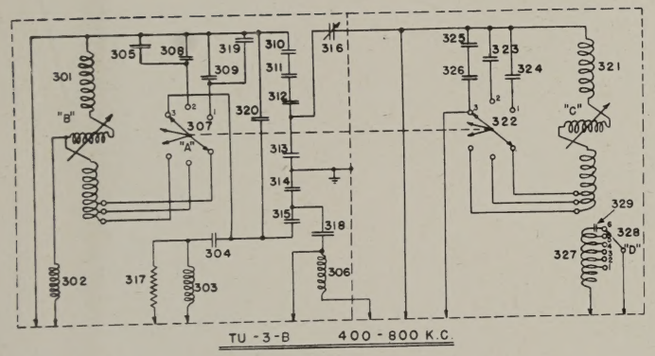
WEIGHT OF TRANSMITTER TUNING UNIT TU-8-B = 11.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-9-B = 11.437 LB

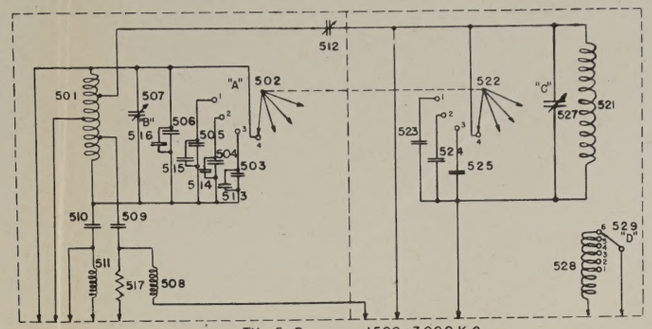
WEIGHT OF TRANSMITTER TUNING UNIT TU-10-B = 11.437 LB

WEIGHT OF TRANSMITTER TUNING UNIT TU-22-B = 12.250 LB

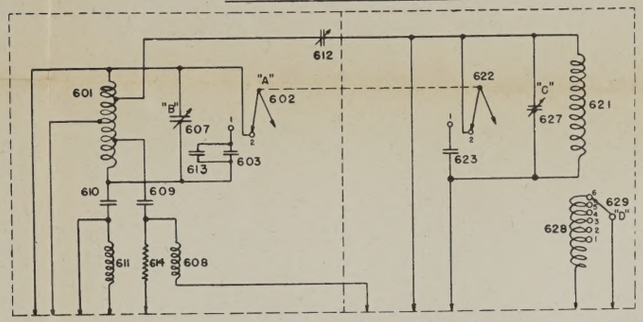
T-7661418 -- Radio Transmitter BC-375-D, Dimensions and Weights



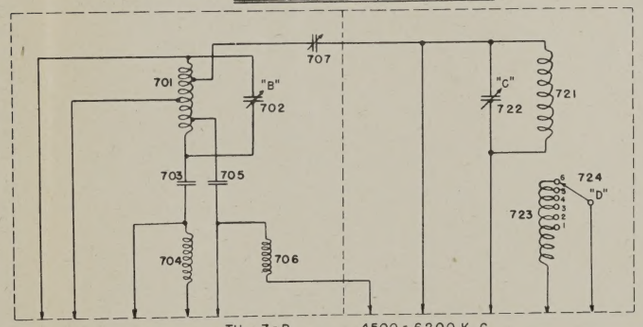
TU-3-B 400-800 K.C.



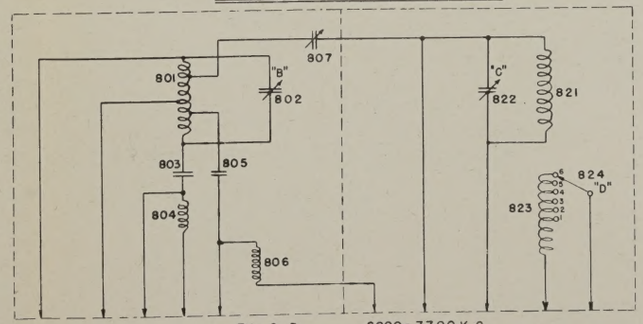
TU-5-B 1500-3000 K.C.



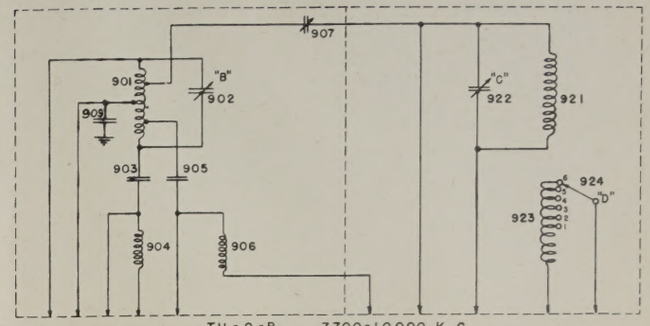
TU-6-B 3000-4500 K.C.



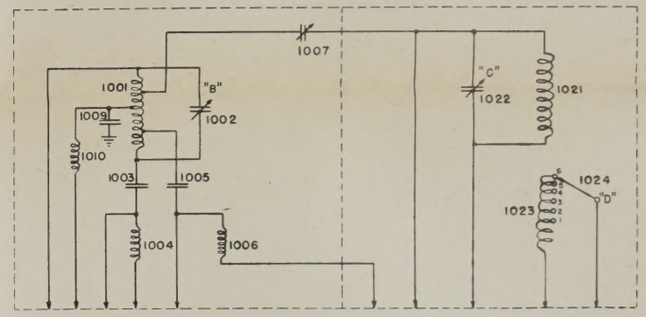
TU-7-B 4500-6200 K.C.



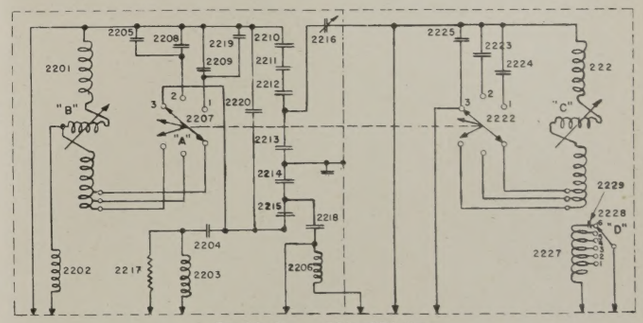
TU-8-B 6200-7700 K.C.



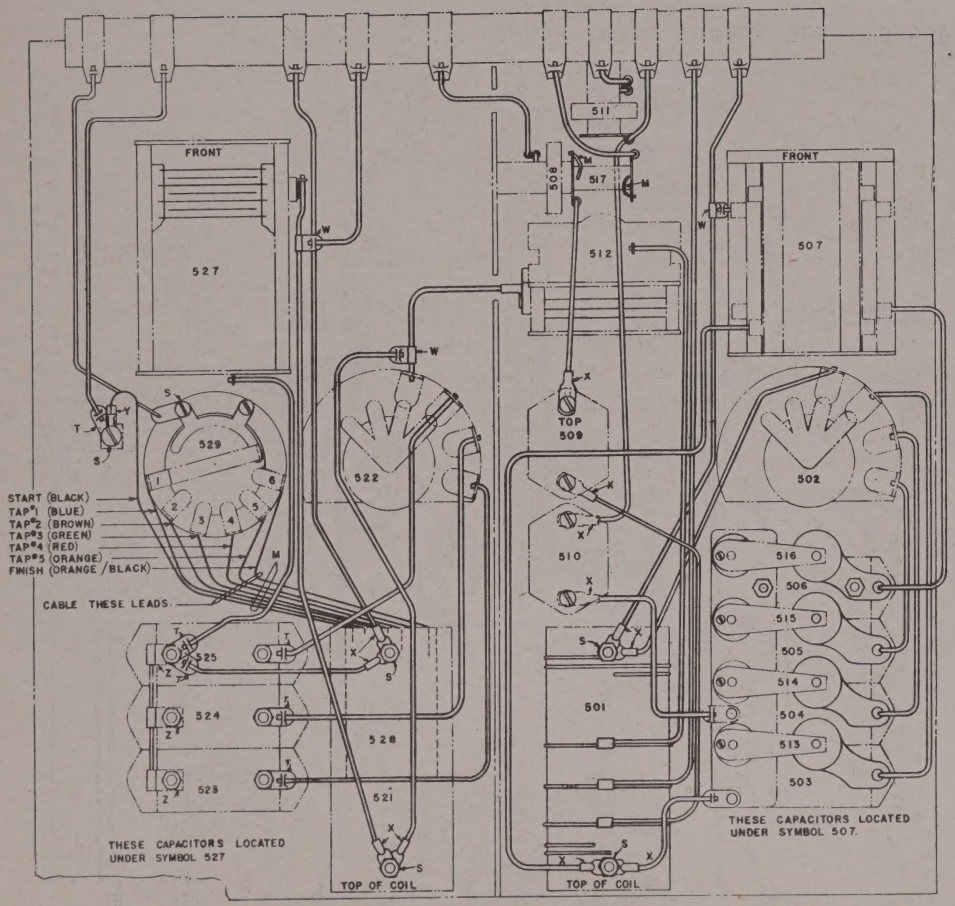
TU-9-B 7700-10000 K.C.



TU-10-B 10000-12500 K.C.



TU-22-B 350-650 K.C.



NOTE FOR SOLDERING :-
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER B20 D3C.

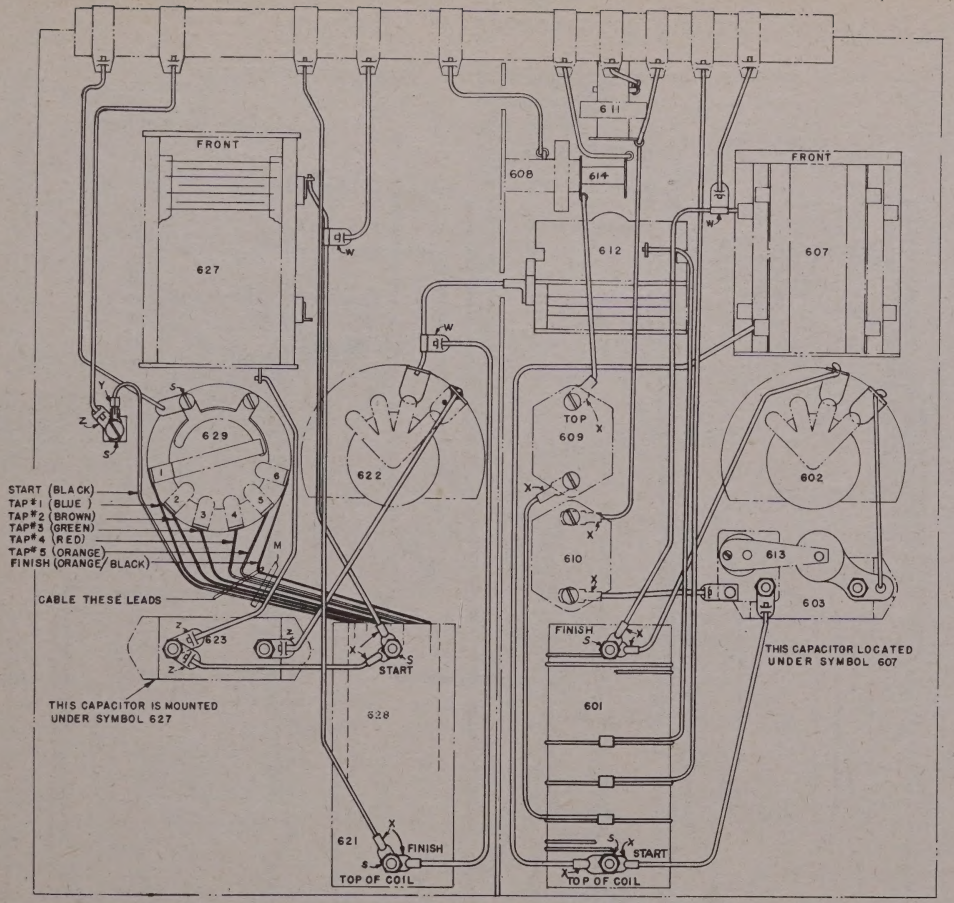
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

SYMBOL	NAME OF UNIT	
501	M.O. TANK INDUCTANCE	
502	M.O. BAND CHANGE SWITCH	
503	M.O. FIXED TANK CAPACITOR	
504	" " " "	
505	" " " "	
506	" " " "	
507	M.O. VARIABLE TANK CAPACITOR	
508	P.A. GRID CHOKE	
509	" " BLOCKING CAPACITOR	
510	M.O. " " "	
511	" " CHOKE	
512	NEUTRALIZING CAPACITOR	
513	M.O. TANK COMPENSATING CAP.	
514	" " " "	
515	" " " "	
516	" " " "	
517	M.O. GRID PARASITIC RESISTOR	
521	P.A. TANK INDUCTANCE	
522	P.A. BAND CHANGE SWITCH	
523	P.A. FIXED TANK CAPACITOR	
524	" " " "	
525	" " " "	
527	P.A. VARIABLE TANK CAPACITOR	
528	ANT COUPLING COIL	
529	" " SWITCH	

CONNECTOR	DESCRIPTION
M	UNIT PIECE OF APPARATUS
NOT MARKED	.102" DIA. COPPER WIRE TINNED.

NOTE :- AT POINTS MARKED "X" USE TERM V-1444451
" " " "Z" " " K-7872717
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "T" " " K-7872305
" " " "S" SOLDER COMPLETE JOINT TOGETHER

P-7763035 -- Transmitter Tuning Unit TU-5-B, Connection Diagram



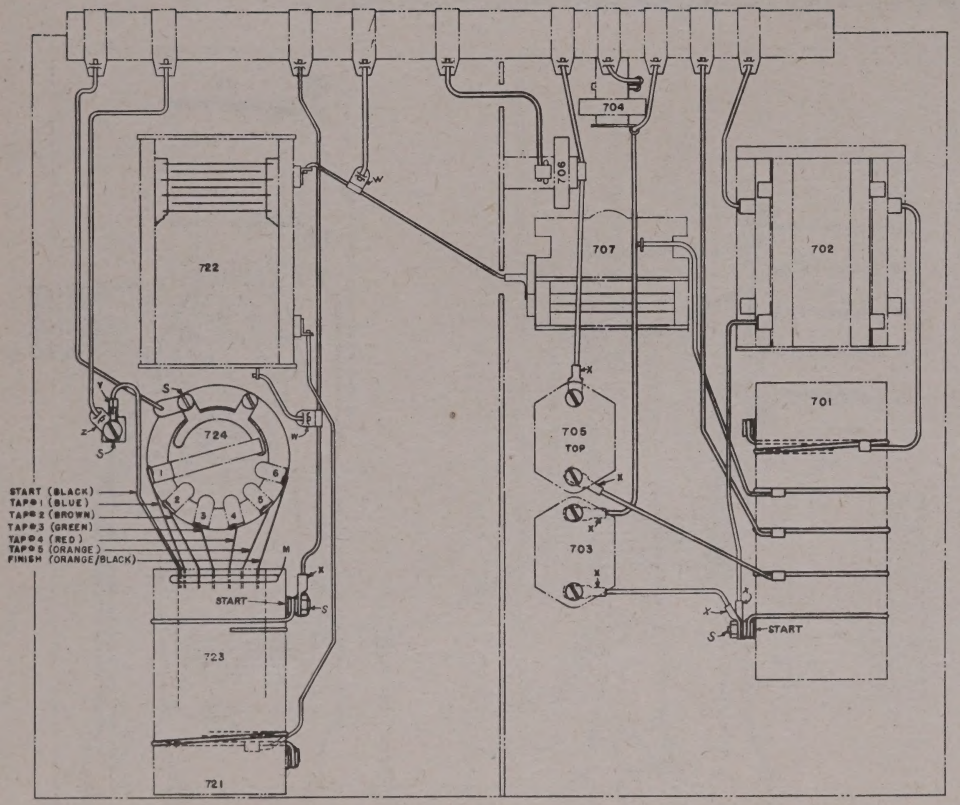
NOTE:
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING.
USE ROSIN CORE SOLDER B20D3C

SYMBOL	NAME OF UNIT
601	M.O TANK INDUCTANCE
602	M.O BAND CHANGE SWITCH
603	M.O FIXED TANK CAPACITOR
607	M.O VARIABLE TANK CAPACITOR
608	P.A GRID CHOKE
609	P.A GRID BLOCKING CAPACITOR
610	M.O GRID BLOCKING CAPACITOR
611	M.O GRID CHOKE
612	NEUTRALIZING CAPACITOR
613	MO. COMPENSATING CAPACITOR
614	P.A GRID PARASITIC RESISTOR
621	P.A TANK INDUCTANCE
622	P.A. BAND CHANGE SWITCH
623	P.A. FIXED TANK CAPACITOR
627	P.A. VARIABLE TANK CAPACITOR
628	ANTENNA COUPLING COIL
629	ANTENNA COUPLING SWITCH

CONNECTION	SIZE OF CONNECTOR
M	UNIT PIECE OF APPARATUS
WIRE MARKED	.102 DIA. COPPER WIRE TINNED

NOTE: AT POINTS MARKED "X" USE TERM V-144451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

P-7763036 -- Transmitter Tuning Unit TU-6-B, Connection Diagram



NOTE:
AT POINTS MARKED "X" USE TERM. V-144445
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER 820D38

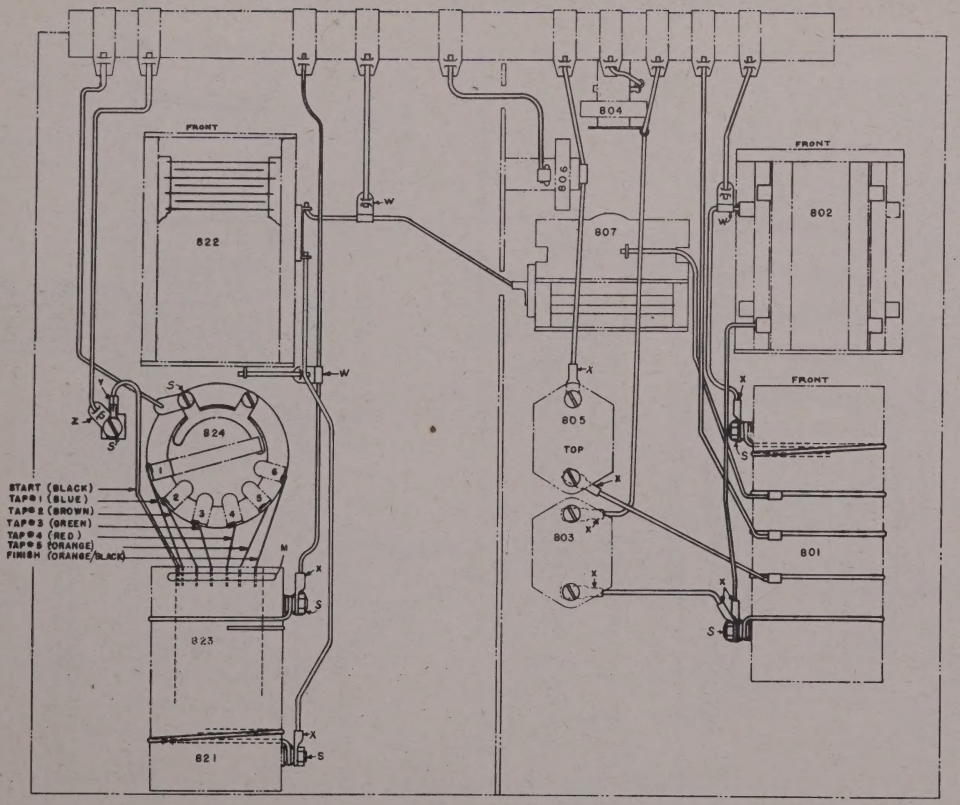
SYMBOL UNIT #7	NAME OF UNIT	
701	M.O. TANK INDUCTANCE	
702	M.O. TANK CAPACITOR	
703	M.O. GRID BLOCKING CAPACITOR	
704	M.O. GRID CHOKE	
705	P.A. GRID BLOCKING CAPACITOR	
706	P.A. GRID CHOKE	
707	NEUTRALIZING CAPACITOR	
721	P.A. TANK INDUCTANCE	
722	P.A. TANK CAPACITOR	
723	ANT. COUPLING COIL	
724	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

P-7763037 -- Transmitter Tuning Unit TU-7-B, Connection Diagram

NOTE:
AT POINTS MARKED "X" USE TERM. V-144451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

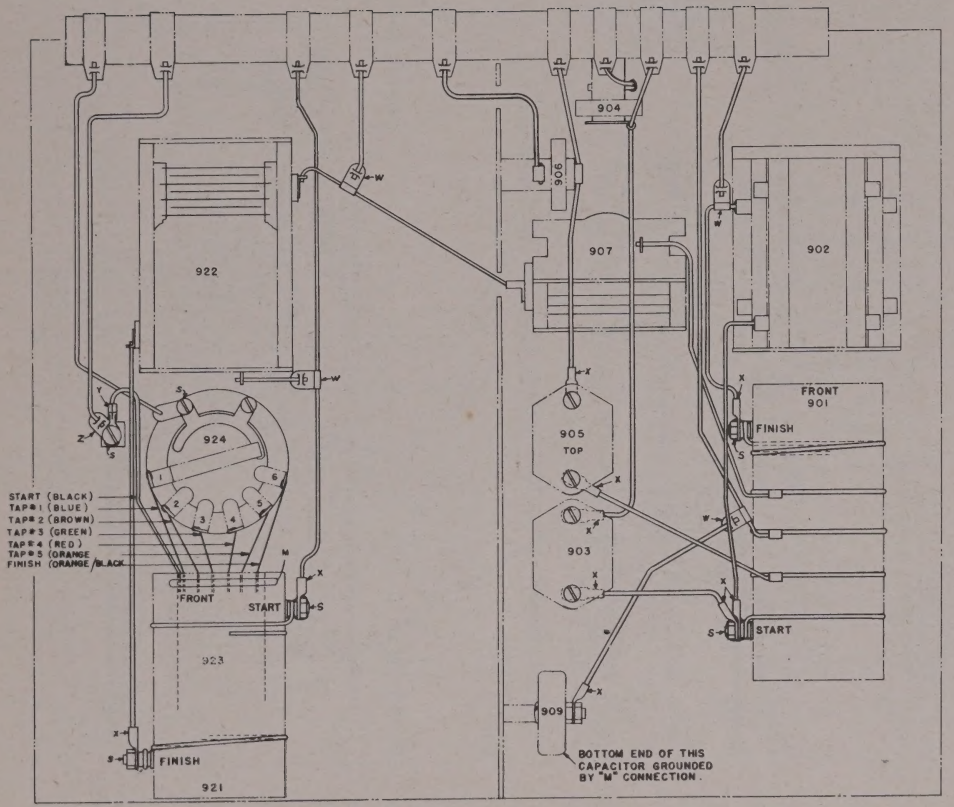
NOTE:
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER 820D38



SYMBOL UNIT # 8	NAME OF UNIT	
801	M.O. TANK INDUCTANCE	
802	M.O. TANK CAPACITOR	
803	M.O. GRID BLOCKING CAPACITOR	
804	M.O. GRID CHOKE	
805	P.A. GRID BLOCKING CAPACITOR	
806	P.A. GRID CHOKE	
807	NEUTRALIZING CAPACITOR	
821	P.A. TANK INDUCTANCE	
822	P.A. TANK CAPACITOR	
823	ANT. COUPLING COIL	
824	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

P-7763038 -- Transmitter Tuning Unit TU-8-B, Connection Diagram



NOTE:
AT POINTS MARKED "X" USE TERM. V-1444451
" " " "Z" " " K-7872305
" " " "Y" " " (V-2454945)
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER 820D3B

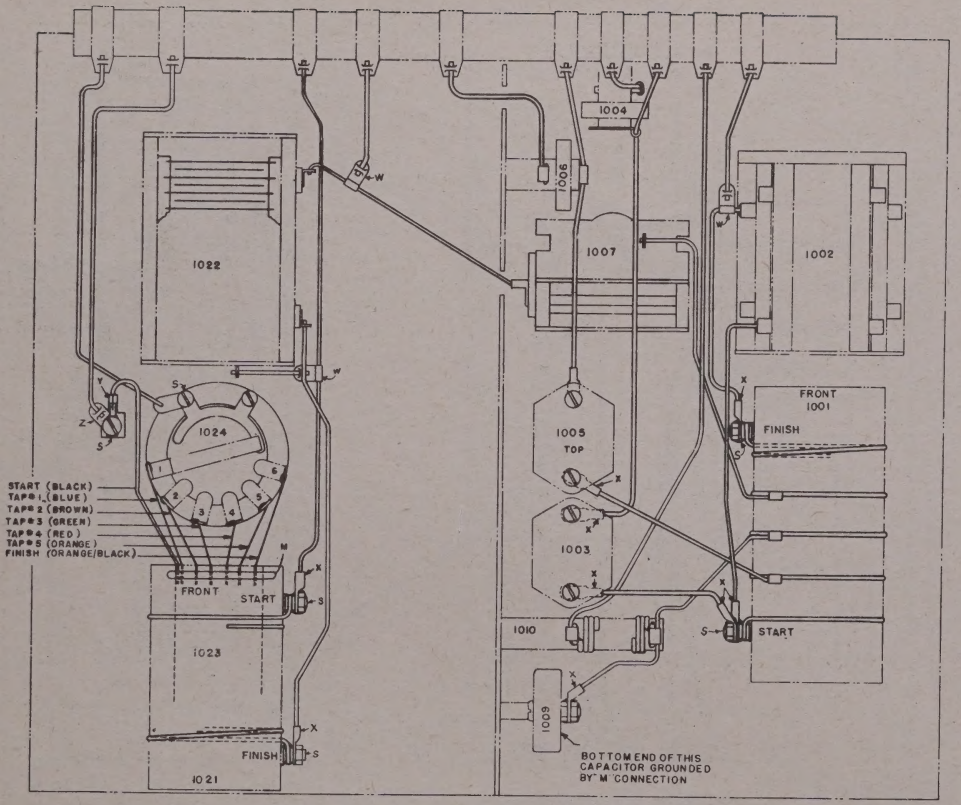
SYMBOL UNIT #9	NAME OF UNIT	
901	M.O. TANK INDUCTANCE	
902	M.O. TANK CAPACITOR	
903	M.O. GRID BLOCKING CAPACITOR	
904	M.O. GRID CHOKE	
905	P.A. GRID BLOCKING CAPACITOR	
906	P.A. GRID CHOKE	
907	NEUTRALIZING CAPACITOR	
909	M.O. BY PASS CAPACITOR	
921	P.A. TANK INDUCTANCE	
922	P.A. TANK CAPACITOR	
923	ANT. COUPLING COIL	
924	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

P-7763039 -- Transmitter Tuning Unit TU-9-B, Connection Diagram

NOTE:
AT POINTS MARKED "X" USE TERM. V-1444451
" " " "Z" " " K-7872305
" " " "Y" " " V-2454945
" " " "W" " " K-7872368
" " " "S" SOLDER COMPLETE JOINT TOGETHER.

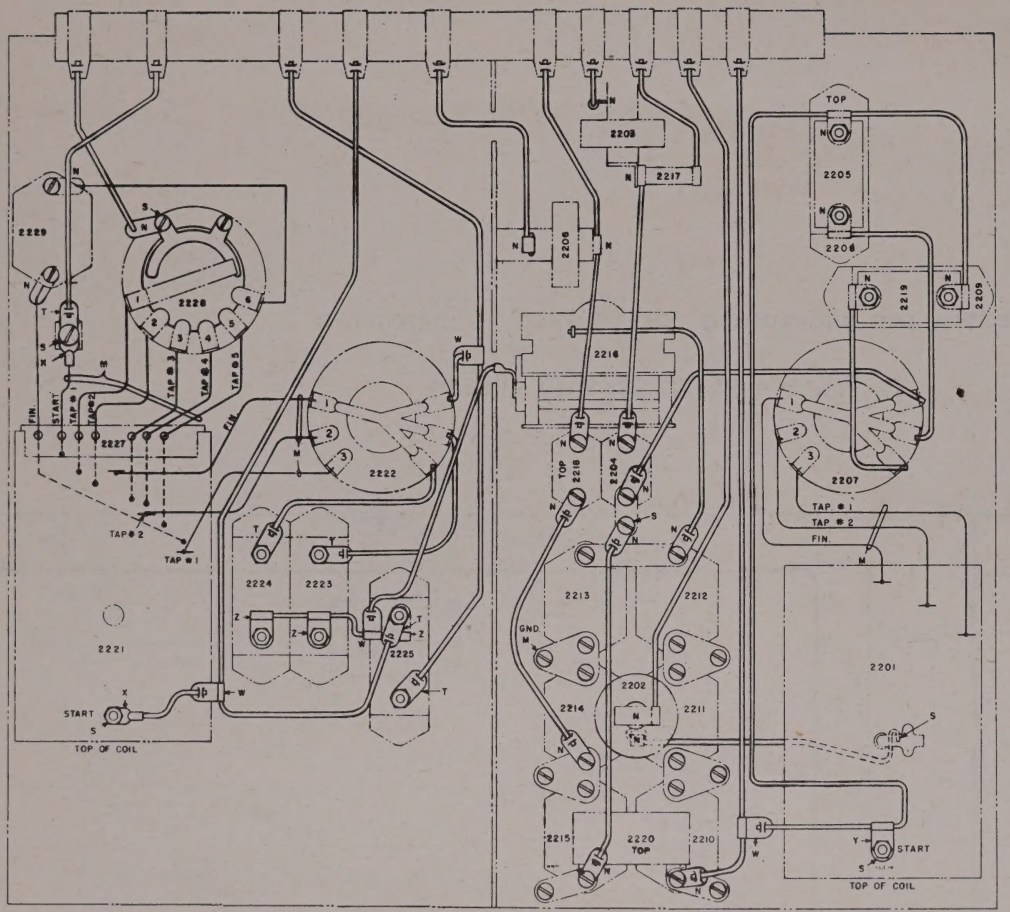
NOTE:-
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING USE ROSIN CORE SOLDER 820D38



SYMBOL UNIT #10	NAME OF UNIT	
1001	M.O. TANK INDUCTANCE	
1002	M.O. TANK CAPACITOR	
1003	M.O. GRID BLOCKING CAPACITOR	
1004	M.O. GRID CHOKE	
1005	P.A. GRID BLOCKING CAPACITOR	
1006	P.A. GRID CHOKE	
1007	NEUTRALIZING CAPACITOR	
1009	M.O. BY PASS CONDENSER	
1010	M.O. CHOKE	
1021	P.A. TANK INDUCTANCE	
1022	P.A. TANK CAPACITOR	
1023	ANT. COUPLING COIL	
1024	ANT. COUPLING SWITCH	

CONNECTION	SIZE OF CONNECTOR
M	SPECIFIED ON MECHANICAL DRAWING
NOT MARKED	COPPER WIRE TINNED .102 DIA.

P-7763040 -- Transmitter Tuning Unit TU-10-B, Connection Diagram



NOTE FOR SOLDERING:-
WIRE TO BE FASTENED MECHANICALLY TO TERMINALS BEFORE SOLDERING. USE ROSIN CORE SOLDER 82OD3C.

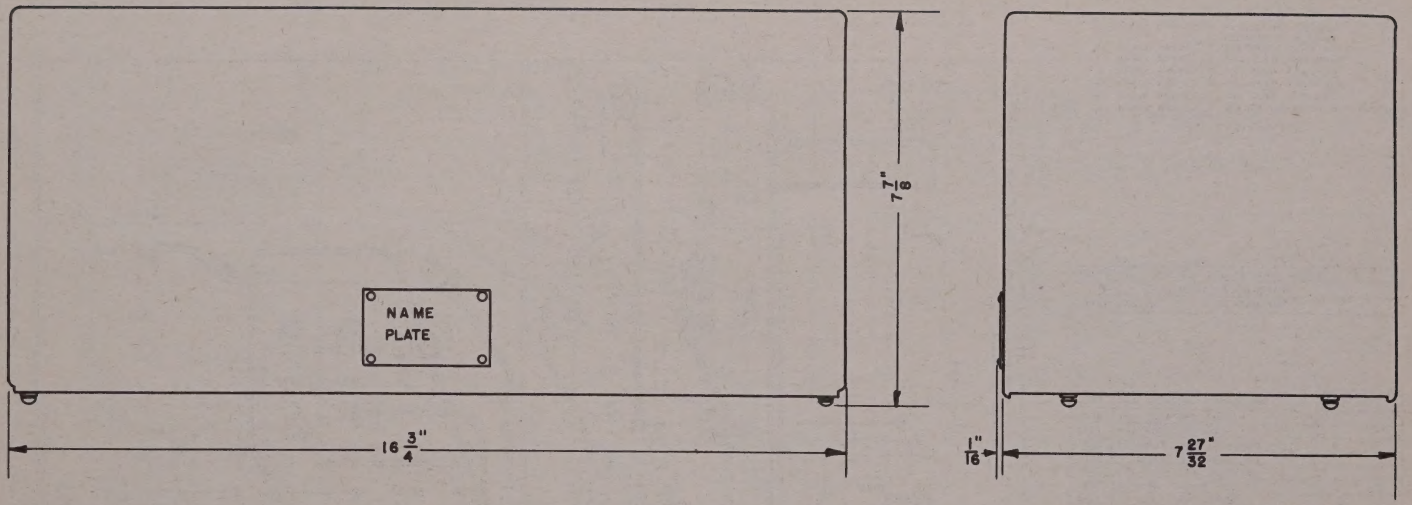
THERE SHALL BE NO SHARP POINTS LEFT AFTER UNIT IS WIRED EITHER FROM LUMPS OF SOLDER OR IRREGULARLY CUT WIRE ENDS.

SYMBOL	NAME OF PART	
2201	M.O. TANK INDUCTANCE	
2202	M.O. PLATE CHOKE	
2203	M.O. GRID CHOKE	
2204	M.O. GRID BLOCKING CAPACITOR	
2205	M.O. TANK COMPENSATING CAP.	
2206	P.A. GRID CHOKE	
2207	M.O. BAND CHANGE SWITCH	
2208	M.O. FIXED TANK CAPACITOR	
2209	M.O. FIXED TANK CAPACITOR	
2210	M.O. CHAIN CAPACITOR	
2211	M.O. CHAIN CAPACITOR	
2212	M.O. CHAIN CAPACITOR	
2213	M.O. CHAIN CAPACITOR	
2214	M.O. CHAIN CAPACITOR	
2215	M.O. CHAIN CAPACITOR	
2216	NEUTRALIZING CAPACITOR	
2217	M.O. GRID PARASITIC RESISTOR	
2218	P.A. GRID BLOCKING CAPACITOR	
2219	M.O. TANK COMPENSATING CAP.	
2220	M.O. TANK COMPENSATING CAP.	
2221	P.A. TANK INDUCTANCE	
2222	P.A. BAND CHANGE SWITCH	
2223	P.A. FIXED TANK CAPACITOR	
2224	P.A. FIXED TANK CAPACITOR	
2225	P.A. FIXED TANK CAPACITOR	
2227	ANT. COUPLING COIL	
2228	ANT. COUPLING SWITCH	
2229	ANT. COUPLING CAPACITOR	

CONNECTOR	DESCRIPTION
M	UNIT PIECE OF APPARATUS
NOT MARKED	.102" DIA. COPPER WIRE TINNED

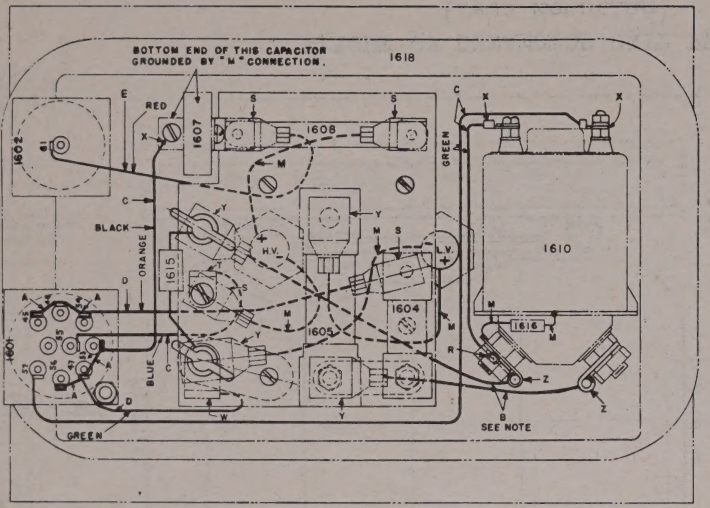
NOTE:- AT POINTS MARKED "S" SOLDER COMPLETE JOINT TOGETHER.
AT POINTS MARKED "T" USE TERM. K-7872305.
AT POINTS MARKED "W" USE TERM. K-7872368.
AT POINTS MARKED "X" USE TERM. V-1444451.
AT POINTS MARKED "Z" USE TERM. K-7870226.
AT POINTS MARKED "N" TERMINALS CALLED FOR ON MECHANICAL DRAWING.
AT POINTS MARKED "Y" USE TERM. V-1451309.

P-7763042 -- Transmitter Tuning Unit TU-22-B, Connection Diagram



WEIGHT OF CASE CS-48 = 4.375 LB

M-7462842 -- Case CS-48, Dimensions and Weight



NOTE:- CUT ALL LEADS TO PROPER LENGTH SUCH THAT THEY TAKE THE POSITIONS SHOWN IN CONNECTION DIAGRAM WHEN TERMINAL BOARD IS SECURED IN PLACE.

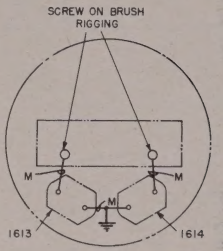
FOR "B" CONNECTION USE EXCESS WIRE CUT FROM L.V. DYNAMOTOR LEADS.

TO PREVENT EXTERNAL BRAID OF "B" CONNECTIONS FROM FRAYING, ASSEMBLE CAP K-7876391 TO RELAY END OF EACH LEAD BEFORE SOLDERING TO TERMINAL.

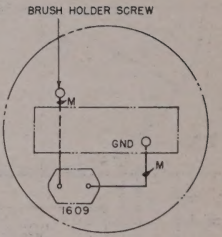
REMOVE METAL IDENTIFICATION TAGS FROM THE FOUR DYNAMOTOR LEADS AFTER CONNECTIONS ARE MADE.

CONNECTION	SIZE OF CONDUCTOR
A	.041" DIA. COPPER WIRE TINNED
B	# 8 AWG. S.I.-12249 (BLACK)
C	# 16 AWG. RUBBER INSULATION K-7872345
D	# 14 AWG. RUBBER INSULATION K-7872345
M	UNIT PIECE OF APPARATUS
E	# 18 AWG. RUBBER INSULATION (RED) K-7872345, PT-11.

CONNECTION	TERMINAL
X	K-7872831
Y	V-416575
Z	K-7870965 PT-2
W	V-1449899 "O"
S	V-417591
T	V-1450858
R	K-7875573

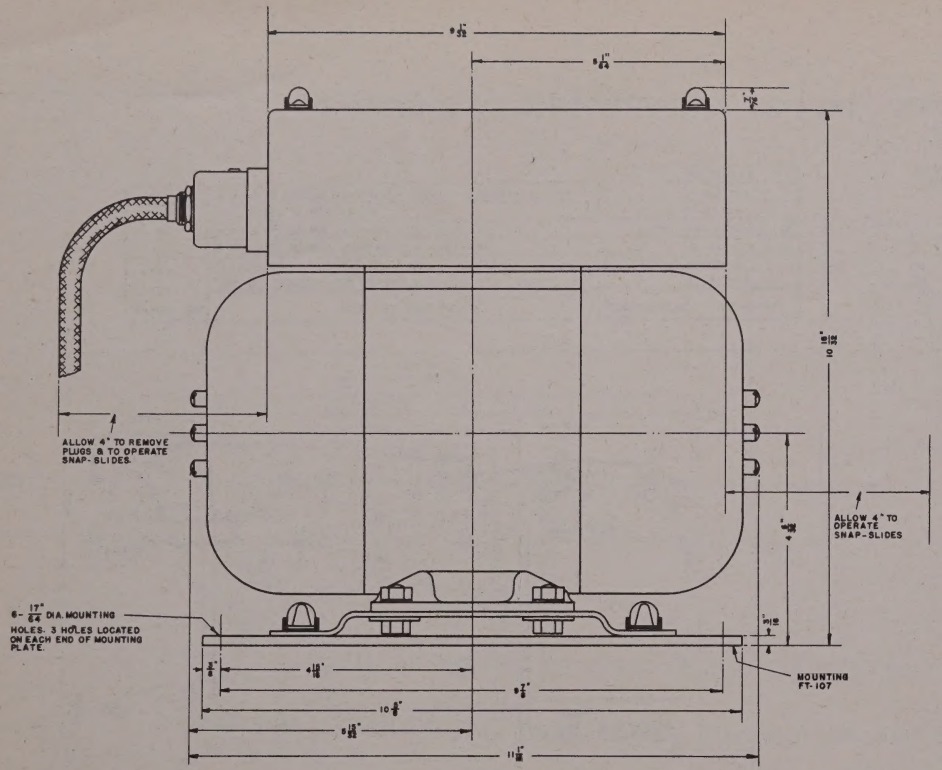


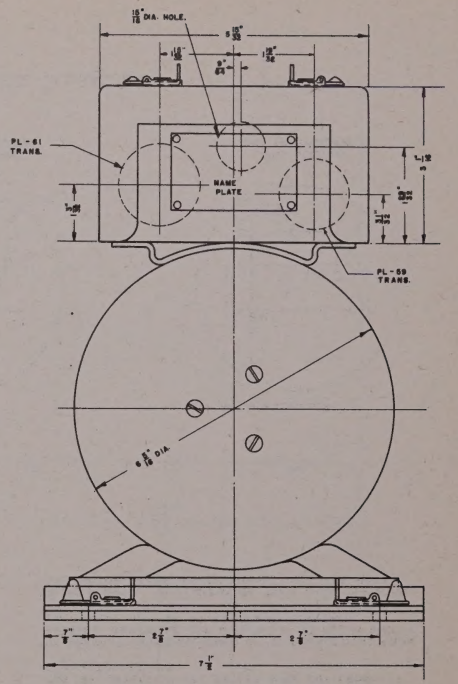
HIGH VOLTAGE END OF DYNAMOTOR



LOW VOLTAGE END OF DYNAMOTOR

P-7762968 -- Dynamotor Unit PE-73-C, Connection Diagram

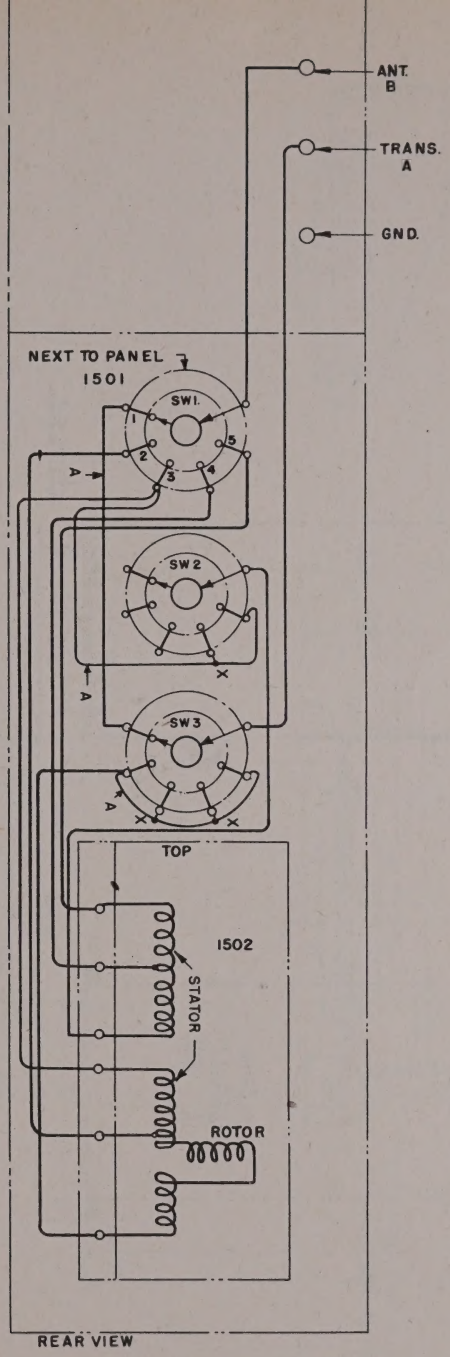

ALLOW 4" TO REMOVE PLUGS & TO OPERATE SNAP-SLIDES.
ALLOW 4" TO OPERATE SNAP-SLIDES
6- 17/64" DIA. MOUNTING HOLES. 3 HOLES LOCATED ON EACH END OF MOUNTING PLATE.
MOUNTING FT-107



WEIGHT OF DYNAMOTOR UNIT PE-73-C (less Mounting) = 37.75 LB

WEIGHT OF MOUNTING FT-107 = 1.45 LB

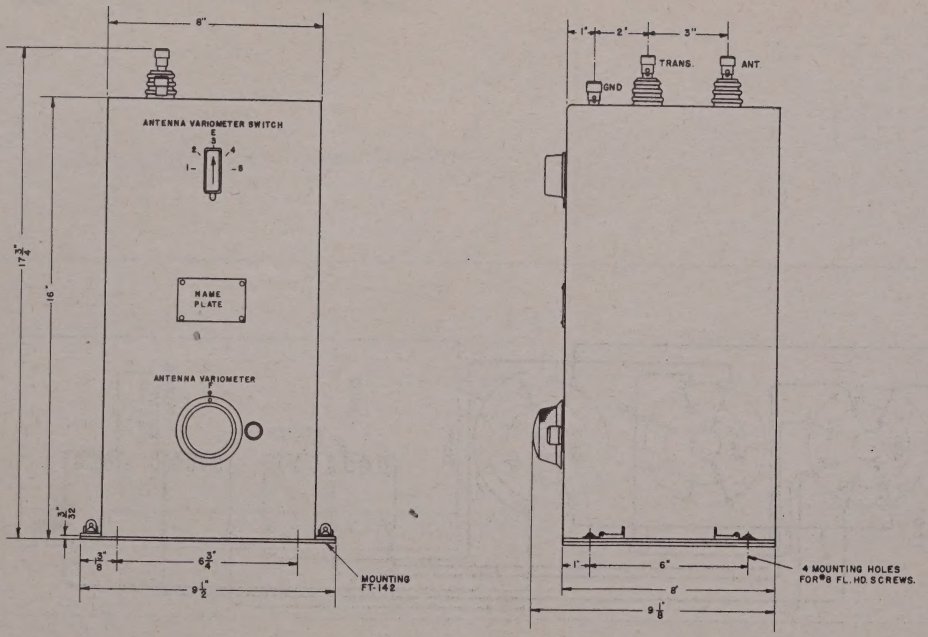
T-7660378 -- Dynamotor Unit PE-73-C, Dimensions and Weight



CONNECTION	SIZE OF CONDUCTOR
UNMARKED	.102" DIA. COPPER WIRE TINNED
A	.080" DIA. COPPERWIRE TINNED

AT POINTS MARKED "X" USE COTTER PIN $\frac{1}{16}$" x $\frac{3}{8}$"

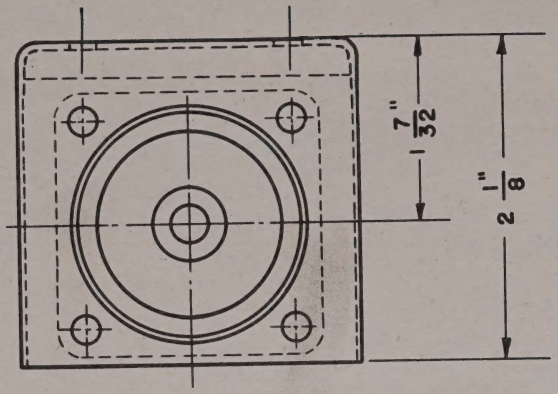
M-7462823 -- Antenna Tuning Unit BC-306-A, Connection Diagram

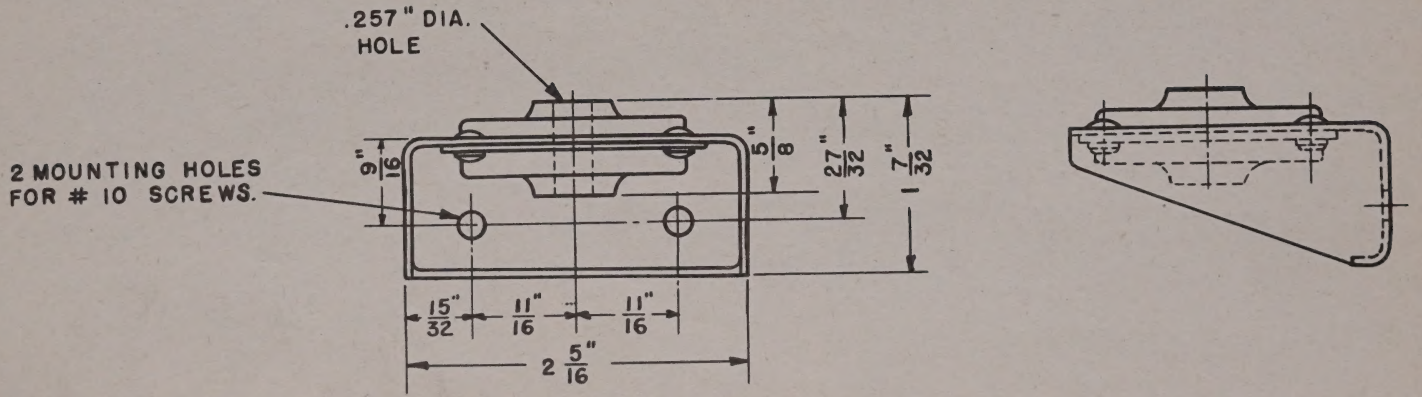


WEIGHT OF ANTENNA TUNING UNIT SIGNAL CORPS. TYPE BC-306-A LESS MOUNTING = 9.062 LBS.

WEIGHT OF MOUNTING SIGNAL CORPS. TYPE FT-142 = .687 LBS.

P-7763324 -- Antenna Tuning Unit BC-306-A, Dimensions and Weight





WEIGHT OF MOUNTING FT-115-B = .195 LB

M-7462838 -- Mounting FT-115-B, Dimensions and Weight